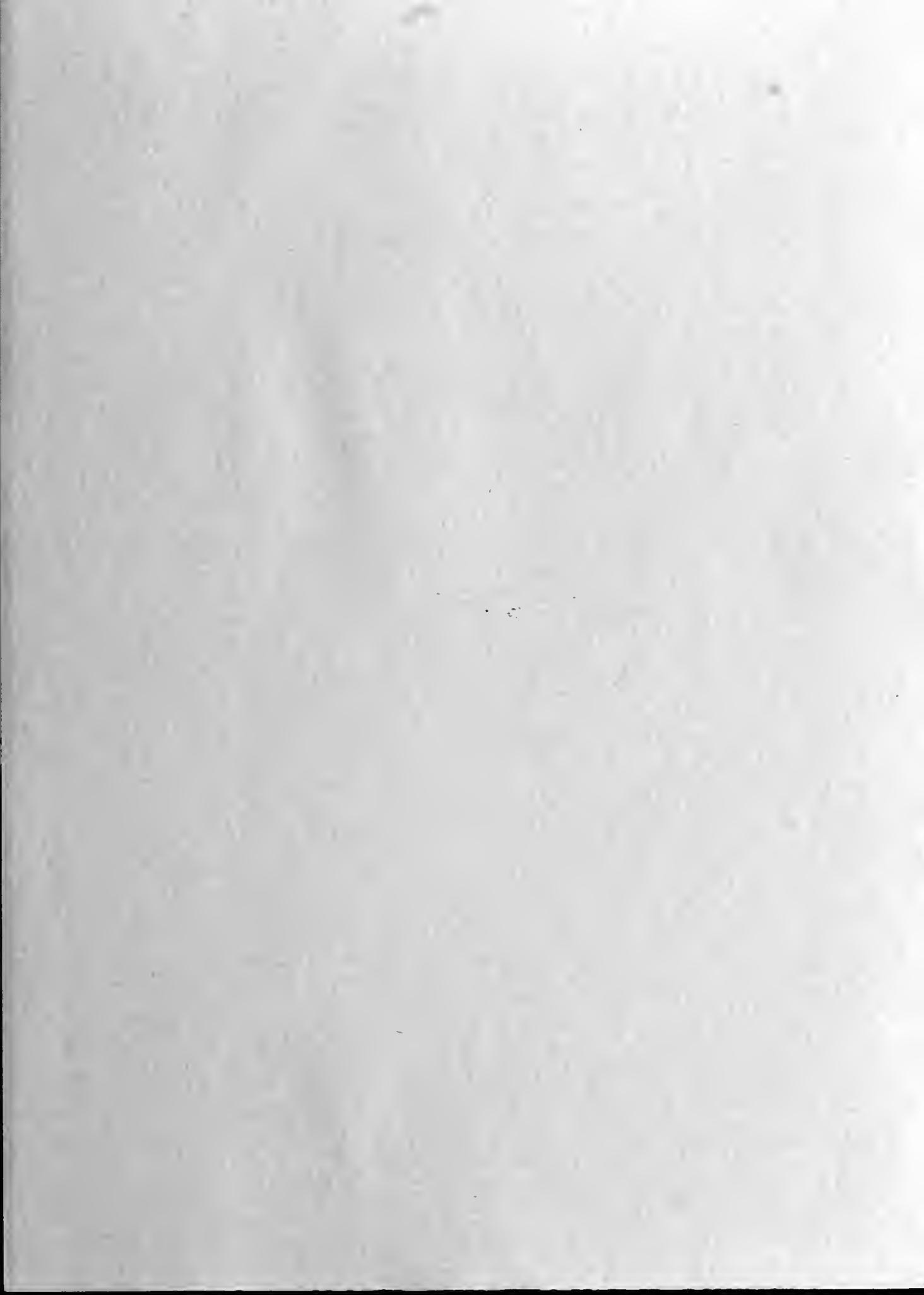


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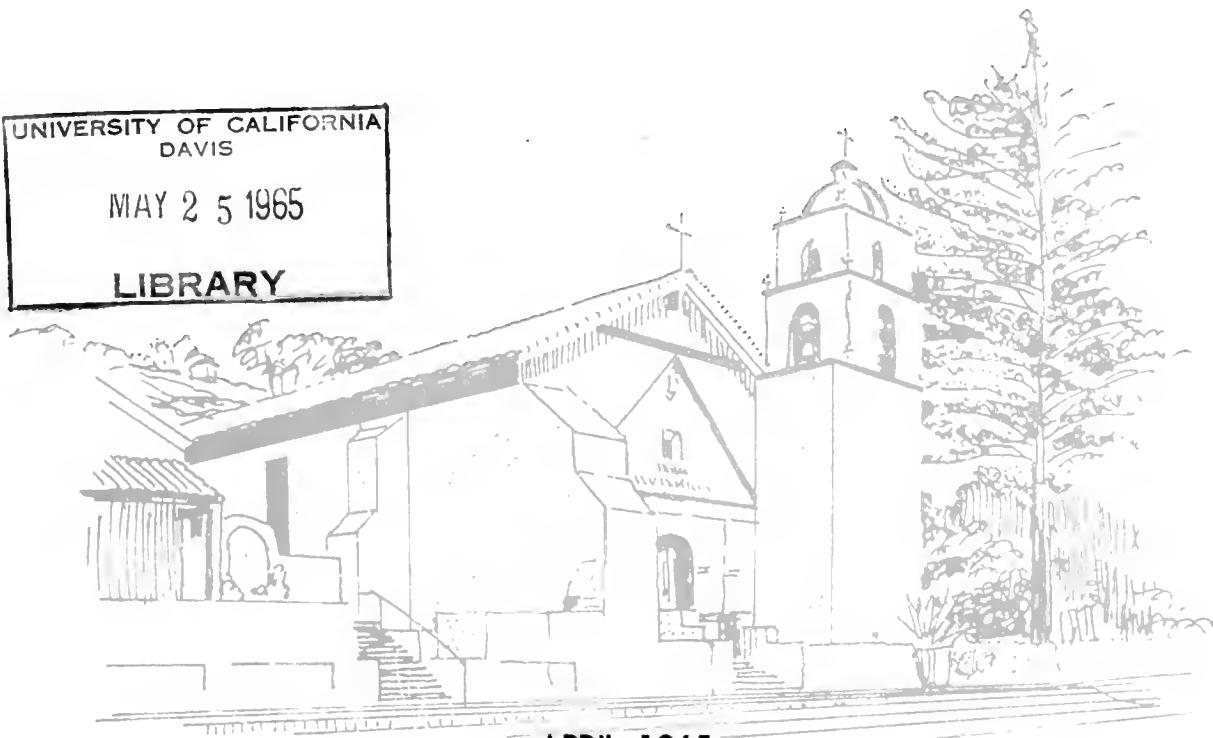


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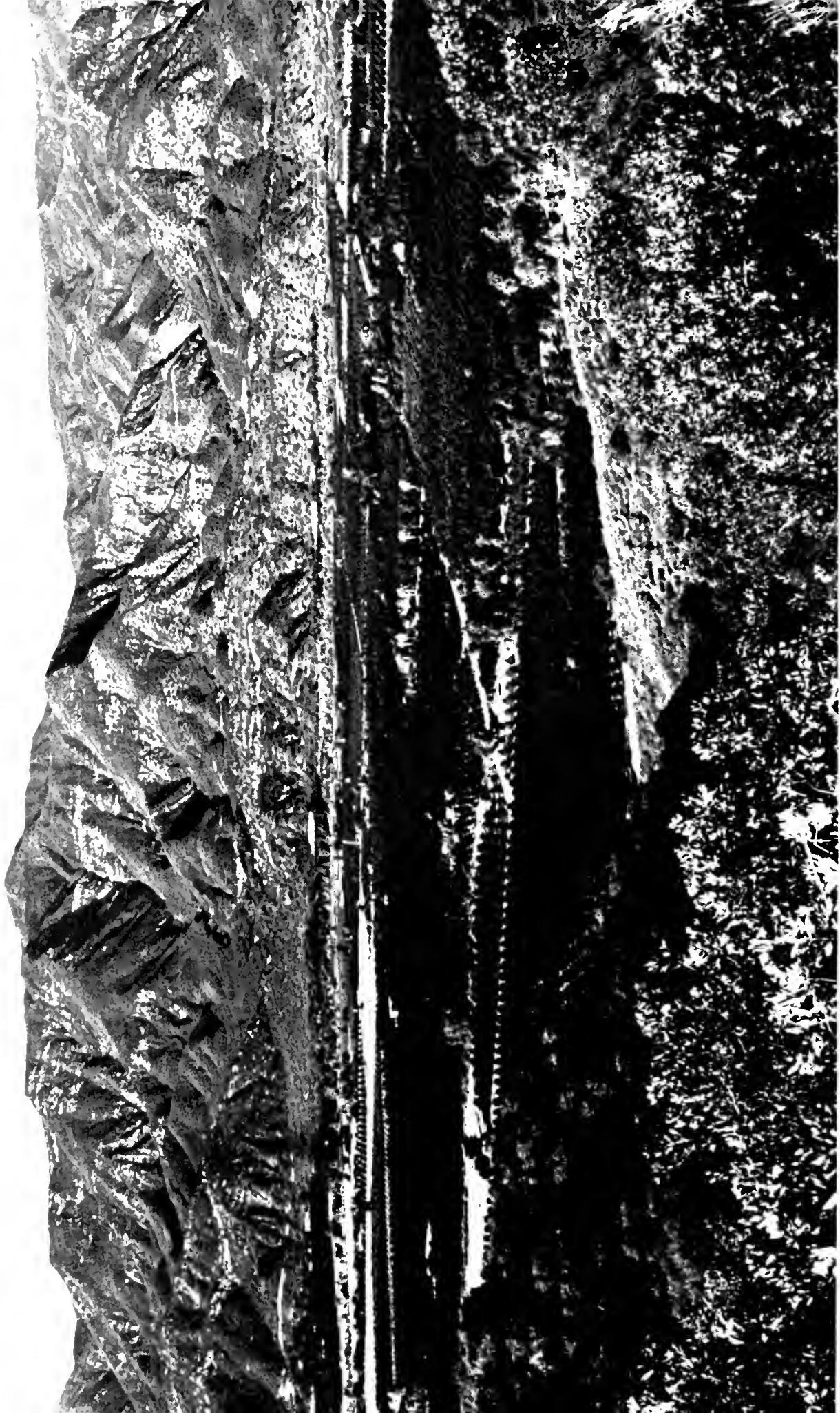
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Administrator
The Resources Agency

EDMUND G. BROWN
Governor
State of California

WILLIAM E. WARNE
Director
Department of Water Resources







Location: Citrus Orchards in Ojai Valley
Courtesy: Josef Muench

State of California
THE RESOURCES AGENCY
Department of Water Resources

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ARTMENT OF WATER RESOURCES

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MENTO

Honorable Edmund G. Brown, Governor, and
Members of the Legislature of the
State of California

Gentlemen:

Department of Water Resources Bulletin No. 122, "Ventura County and Upper Santa Clara River Drainage Area Land and Water Use Survey, 1961", was prepared as a part of the department's continuing program of studies of the use of the water resources of the State, pursuant to Sections 225, 226, and 232 of the California Water Code. Present water use and population are the basis for predictions of future water requirements and the need for additional water development.

All of Ventura County, and a portion of Los Angeles County along the Santa Clara River, were surveyed during the investigation, and data on land and water use for this area in 1961 are presented in the report. Changes in land and water use since 1950, the year of the previous survey, were also evaluated.

During the 11-year period between 1950 and 1961, there was an increase of about 15 percent in the water service area. The water use in the area of investigation increased at almost the same rate to approximately 225,400 acre-feet per year. It is predicted that in 1990 annual water use will increase to about 356,400 acre-feet, or about 142,600 acre-feet in excess of the safe yield of local water resources.

The increasing use of water in Ventura County and in other areas of Southern California, coupled with the limited local water supplies, emphasizes the need for optimum development of local water resources and for importation of supplemental water to the area.

Sincerely yours,

A handwritten signature in black ink, appearing to read "William E. Warne".

Director

AUTHORIZATION

The California Legislature of 1929 enacted legislation, providing for investigations of this kind, as follows:

"Section 1. Out of any money in the state treasury not otherwise appropriated, the sum of four hundred fifty thousand dollars*, or so much thereof as may be necessary, is hereby appropriated to be expended by the state department of public works in accordance with law in conducting work of exploration, investigation and preliminary plans in furtherance of a coordinated plan for the conservation, development and utilization of the water resources of California including the Santa Ana river and its tributaries, the Mojave river and its tributaries, and all other water resources of southern California" (California Statutes of 1929, Chapter 832, Section 1).

*Reduced by the Governor to \$390,000.

Subsequent sessions of the Legislature have appropriated funds for continuing investigations of the water resources of Southern California in accordance with legislative intent expressed in the foregoing statute and in Sections 225 and 226 of the California Water Code, quoted as follows:

"225. The department may carry on topographic surveys and investigations into matters pertaining to the water resources of the State along the lines of hydrography, hydro-economics, and the use and distribution of water for agricultural purposes, and to that end, where possible and to the best interest of the State, shall enter into contracts for cooperation with the different departments of the Federal Government. The department, with the consent of the Governor, may maintain and continue such surveys and investigations where there is available money not covered by cooperative contract.

226. The department, either independently or in co-operation with any person or any county, state, federal, or other agency, may do any of the following:

- (a) Conduct investigations of all or any portion of any stream, stream system, lake or other body of water.
- (b) Investigate either or both surface and underground water conditions.
- (c) Collect records of diversion and use of water.
- (d) Supervise distribution of water in accordance with agreements and court orders therefor.

(e) Conduct investigations of the rate of use of water for various purposes and considering various soil conditions."

In 1956 the State Legislature further directed the Department of Water Resources to make continuing investigations to develop "information as to water which can be made available for exportation from the watersheds in which it originates without depriving those watersheds of water necessary for beneficial uses therein". This legislation specifically requested investigation of and reports on the following matters:

"(a) The boundaries of the respective watersheds of the State and the quantities of water originating therein; (b) The quantities of water reasonably required for ultimate beneficial use in the respective watersheds; (c) The quantities of water, if any, available for export from the respective watersheds; (d) The areas which can be served by the water available for export from each watershed; and (e) The present uses of water within each watershed together with the apparent claim of water right attaching thereto, excluding individual uses of water involving diversions of small quantities which, in the judgment of the Director of Water Resources, are insufficient in the aggregate to materially affect the quantitative determinations included in the report."

(California Statutes of 1956, First Extra Session, Chapter 61; Water Code Section 232).

Pursuant to the foregoing legislative directives, the Department of Water Resources began a program of continuing surveys of land and water use in the water-deficient Southern California area during 1957. Surveys are usually made each year in portions of Southern California, so that land and water use are determined at periodic intervals for every area.

ACKNOWLEDGMENT

A portion of the data compiled in this investigation and presented in the report were contributed by numerous public and private agencies whose cooperation is gratefully acknowledged. Special mention is made of the assistance and cooperation received from the following:

Ventura County Tax Assessor's Office
Los Angeles County Regional Planning Commission
Ventura County Director and Farm Advisor
Ventura County Agricultural Commissioner

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

EDMUND G. BROWN, Governor
HUGO FISHER, Administrator, The Resources Agency
WILLIAM E. WARNE, Director, Department of Water Resources
ALFRED R. GOLZE', Chief Engineer
JOHN M. HALEY, Assistant Chief Engineer

SOUTHERN DISTRICT

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This investigation and the preparation of this report
were conducted under the direction
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**Donald H. McKillop was Chief of the Water Supply and Utilization Section until November 29, 1963.



Location: Conejo Valley

Courtesy: Spence Air Photos

The expanding perimeter of urban development in Los Angeles County spilled

CHAPTER I. INTRODUCTION

The pastoral rolling hills and agricultural valleys of Ventura County and the Upper Santa Clara River Drainage Area are experiencing rapid changes in land and water use. The rural character of the landscape had remained somewhat stable until the expanding perimeter of urban development of Los Angeles County spilled over into the area. Increasing industrial decentralization in the Los Angeles area has also brought light industry to Ventura County, and the resulting increase in employee population has afforded new opportunity for commercial service and supply enterprises to develop. The increased momentum of industrial and residential development is paralleled by an equivalent rise in water utilization. As a result, additional water supplies must be developed to meet the current and expanding needs of this area.

This bulletin is one of a series presenting the results of land and water use studies made by the Department of Water Resources. It contains the results of a land and water use survey conducted in 1961 in Ventura County and the Upper Santa Clara River Drainage Area in Los Angeles County. This report presents information on urban and agricultural development in the study area, and the present and projected water requirements for this cultural development.

Objectives and Scope of Investigation and Report

Land use information has been gathered to obtain basic data from which present water use is computed. Knowledge of current patterns of land use also permits an analysis of the direction and magnitude of land use changes taking place between surveys. This information, coupled

with computations of changes in water use, provides a basis upon which future water requirements can be determined and water supply importation and distribution systems planned.

The material presented herein is intended for the use of water supply agencies in making the most effective use of existing water supplies and in developing additional supplies to meet current and expected deficiencies. The report is also intended for the information of the State Legislature and interested members of the public.

This report contains the results of a comprehensive survey made in 1961 of the nature and extent of land and water use within Ventura County and the Upper Santa Clara River Drainage Area. The survey area boundaries are shown on Plate 1, "Area of Investigation".

In addition to showing present land use, this report contains estimates of present water use. Data obtained from the land use surveys conducted by the State Department of Water Resources and its predecessor agencies were utilized as the basis for comparison between 1950 and 1961 land and water use patterns. Data on local water supplies were developed from the previously mentioned bulletins and from material in the department's files.

In this report, terms which require clarification are defined at the point where they first occur in the text, and are further defined in Appendix A.

Land use data collected by the Department of Water Resources are processed by machine techniques, which permit the evaluation of these data in terms of a sizable number of hydrologic, geographic, or political subdivisions with different boundaries. The tabulations in the main body

of this report give land use within the boundaries which are thought to be the most generally useful. Additional land use tabulations for hydrologic units and subunits are given in Appendix B. Appendix C contains a list of districts, areas, and units for which individual tabulations of 1961 land uses can be obtained by machine data-processing methods, based on material available in the department's files.

Related Investigations and Reports

The California Legislature of 1947, by Chapter 1541, Statutes of 1947, directed the Department of Water Resources and its predecessor agencies to conduct a comprehensive investigation of the water resources of the entire State of California. The investigation had as its purpose the preparation of The California Water Plan. Results of the investigation are contained in three California State Water Resources Board publications: Bulletin No. 1, "Water Resources of California", 1951; Bulletin No. 2, "Water Utilization and Requirements of California", June 1955; and Bulletin No. 3, "The California Water Plan", May 1957. Some historical data were also obtained from Division of Water Resources Bulletin No. 46, "Ventura County Investigation", 1933.

Two bulletins that were invaluable in the preparation of this report were the previously mentioned Bulletin No. 2 and California State Water Resources Board Bulletin No. 12, "Ventura County Investigation", April 1956. Both of these bulletins reported land and water use for the same period but Bulletin No. 12 presented the data for Ventura County in greater detail. California State Department of Water Resources Bulletin

No. 24-60, "Coastal Los Angeles County Land and Water Use Survey, 1960", proved to be a helpful reference for the Los Angeles County portion of the study.

In addition to the above reports, a list of other references consulted is included in Appendix D.

CHAPTER II. AREA OF INVESTIGATION

The area of investigation is generally northwest of Los Angeles and comprises all of Ventura County (excluding offshore islands), and the portion of Los Angeles County that is tributary to the Santa Clara River. In addition, small adjoining areas in Santa Barbara County and Kern County were also included in order to complete hydrologic units. The general location of the study area is shown on Plate 1, while the boundary of the area is shown in detail on Plate 2, "Ground Water Basins, Hydrologic Units, Subunits, and Subareas".

Location and Description

The investigational area is generally characterized by rugged mountainous terrain in the north and east which recedes in the south and west to rolling hills, alluvial valleys and coastal floodplains where most of the present cultural development is concentrated. The mountainous area is comprised of the Santa Ynez, Topatopa, Piru, San Gabriel, and Santa Monica Mountains. Numerous ridges in the mountains rise to elevations in excess of 6,000 feet, while some peaks attain elevations in excess of 8,000 feet. The investigational area extends inland from the ocean approximately 56 miles. The maximum east-west width is about 80 miles and there are about 45 miles of coastline. The entire area covers 1,696,130 acres--about 2,650 square miles.

The area is drained by four principal stream systems: the Ventura River, the Santa Clara River, Calleguas Creek, and the Cuyama River. With the exception of the Cuyama River, these streams discharge into the ocean along the coastal portion of Ventura County. The headwaters



Location: Port Hueneme

Courtesy: Spence Air Photos

of the Cuyama River rise in the northwestern portion of Ventura County and the course of the river is to the northwest, outside the investigational area; flows from the Cuyama River are eventually discharged into the ocean through the Santa Maria River. In addition to the foregoing principal streams, there are many minor water courses and drainage systems which are discussed in the section describing hydrologic units.

A mediterranean type of climate, typical of the south coast of California, prevails throughout most of the study area. Dry, warm, summers are followed by short, wet, winters accompanied by cooler temperatures. Seasonal precipitation is variable, ranging from below 10 inches along the coast to over 30 inches in the mountains, with some snow occurring at the higher elevations. Most of the precipitation occurs from December to March. Fog is prevalent along the coast and in some interior areas. The growing season is long, but generally decreases with distance from the warming influence of the coast. Climatological data for representative stations in Ventura County and the Upper Santa Clara River Drainage Area are presented in Table 1.

TABLE 1

CLIMATOLOGICAL DATA FOR REPRESENTATIVE AREAS OF VENTURA COUNTY AND UPPER SANTA CLARA RIVER DRAINAGE AREA

Station	: Elevation, : in feet	: Average : temperature, : in degrees : F	: Mean seasonal : precipitation, : in inches*	: Precipitation : Oct. 1, 1960 : to Sept. 30, : 1961, in inches
Oxnard	51	58.9	14.47	7.30
Ojai	750	61.1	18.76	8.97
Santa Paula	275	61.5	17.50	7.23
Newhall-Soledad	1,243	----	17.98	7.05

* Based on 50-year period, 1897-98 through 1946-47.

More detailed descriptions of the investigational area are presented in the following section describing hydrologic units.

Hydrologic Units

There are nine hydrologic units within Ventura County and the Upper Santa Clara River Drainage Area. Although some of these units extend beyond the boundaries of the study area, only the portions of such units within the boundaries shown on Plate 2 were surveyed for the present investigation. Information on land and water use in units that extend across these boundaries may be found in bulletins of the Department of Water Resources which report on land use investigations in adjoining areas. For purposes of hydrologic analysis, some of the units have been divided into subunits and subareas which are depicted along with hydrologic units on Plate 2. The gross areas of the hydrologic units surveyed are presented in Table 2.

TABLE 2

GROSS AREAS OF HYDROLOGIC UNITS IN VENTURA COUNTY AND UPPER SANTA CLARA RIVER DRAINAGE AREA

Hydrologic units	:	Gross area, in acres
Santa Maria-Cuyama*		159,880
Santa Ynez*		1,670
Santa Barbara*		7,110
Rincon Creek		14,010
Ventura River		150,480
Santa Clara-Calleguas		1,286,470
Malibu*		52,540
Los Angeles-San Gabriel River*		6,180
San Joaquin Valley*		<u>17,790</u>
TOTAL		1,696,130

* Hydrologic unit extends beyond boundary of study area; acreage shown is only for portion of hydrologic unit that was surveyed for the present investigation.

The following is a brief description of each hydrologic unit included in this investigation:

Santa Maria-Cuyama Unit

The portion of this hydrologic unit within the boundaries of the area of investigation is located in the northwestern corner of Ventura County; the unit covers an area of 159,880 acres. The topography of this unit is mountainous, with some peaks reaching elevations of over 8,000 feet. Principal canyons in the unit are Quatal, Apache and Dry Canyons, all tributary to the Cuyama River, which flows northwest out of the investigational area. The ground water basin in this area consists of recent alluvium and is considered to be unconfined.

Santa Ynez Unit

Only 1,670 acres of this hydrologic unit were considered in this study; the major portion of the unit extends beyond the western part of the investigational area. There is no development within the small portion surveyed; therefore, no further discussion of the unit will be made. However, the unit will be listed in the various tables throughout the report to complete the inventory of land and water uses.

Santa Barbara Unit

Most of this unit lies outside of Ventura County, with only 7,110 acres lying within the southwestern part of the investigational area. A small portion is in irrigated agriculture and urban-suburban land use. Ground water basins in this portion of the unit are small and consist of older geologic formations, containing water of poor quality.

The basin areas are considered to be unconfined; nevertheless, very little recharge occurs, and that which percolates is degraded to a point that it becomes unusable.

Rincon Creek Unit

This complete unit comprises an area of 14,010 acres. The unit is located along the ocean between the Ventura River and the Santa Barbara-Ventura county line, and extends inland for about four miles, to a point just south of Casitas Reservoir. Very little water-bearing material occurs, and most of that is restricted to the alluvial-filled valley bottoms, beach deposits, and thin terrace deposits. Because of these conditions, this unit is considered to be a confined ground water basin for purposes calculating water use.

Ventura River Unit

This hydrologic unit is located in the southwest part of the investigation area and totals 150,480 acres, all of which lie within the study area. Free ground water conditions generally prevail throughout the upper part of the basin, although there are some localized bodies of confined water. The Lower Ventura River Subunit is generally underlain by nonwater-bearing formations and is considered confined for purposes of calculating water use. There are two important reservoirs in the unit--Matilija and Casitas, shown on Plate 2. Matilija Reservoir is located northwest of Ojai and has a capacity of about 7,000 acre-feet. Casitas Reservoir, with a capacity of 250,000 acre-feet, is the largest reservoir within the investigation area.

Santa Clara-Calleguas Unit

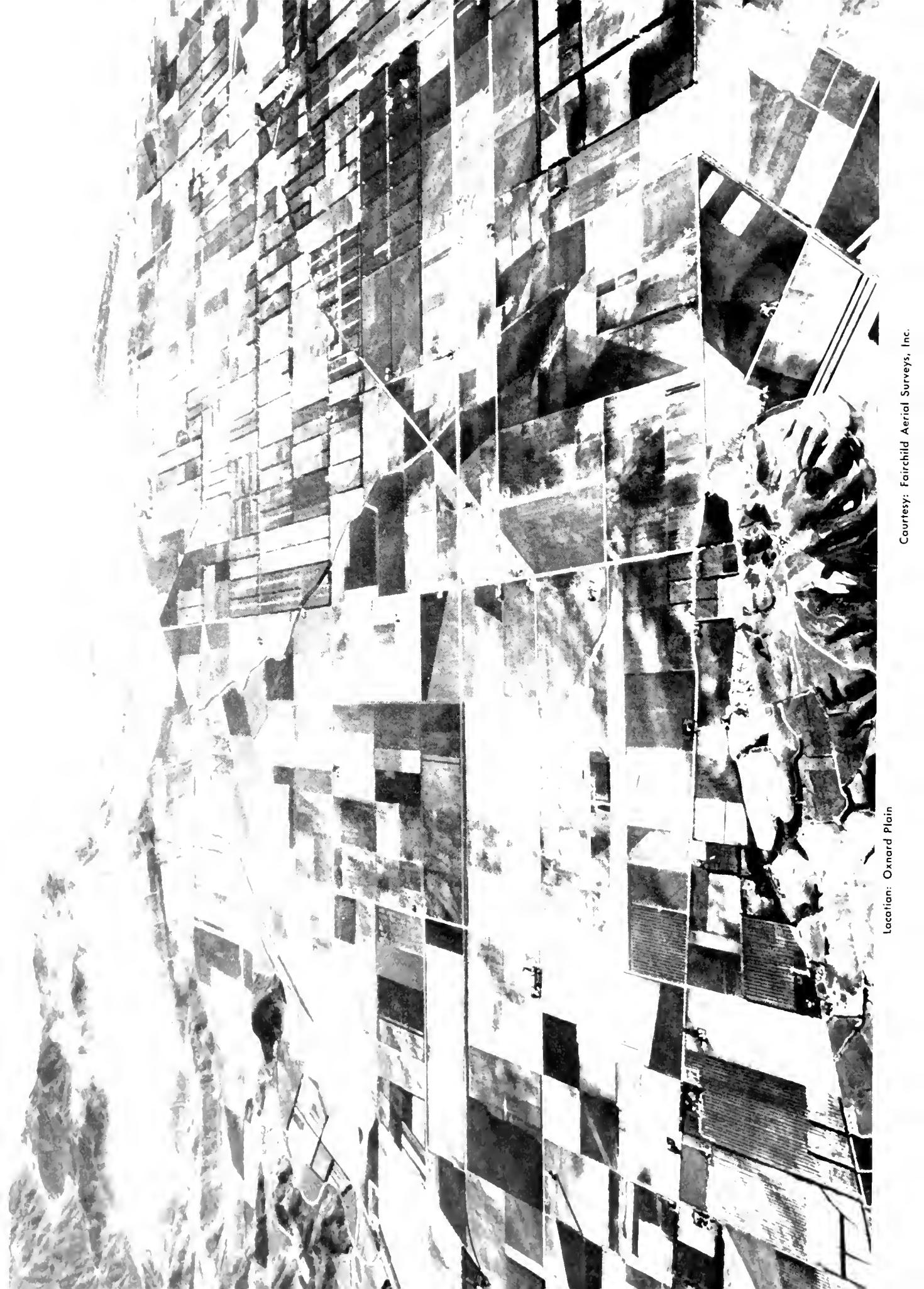
This complete hydrologic unit comprises 1,286,470 acres of both mountainous and valley land, or about 75 percent of the investigational area. The principal stream system in this unit is the Santa Clara River; other important streams are Piru, Calleguas, Castaic, Sespe, and Santa Paula Creeks.

Over 95 percent of the agriculture within the investigational area is found in this unit. The upper part of the unit is characterized by the wide Santa Clara Valley where grain, walnuts, and citrus prevail. Toward the coast the Santa Clara River has formed a coastal plain which is extensively planted to field and truck crops.

Bouquet Reservoir and Lake Piru are the two largest reservoirs within the unit. Ground water occurring in the interior part of this unit is considered unconfined, whereas that occurring in the pumped aquifers of the Oxnard, Pleasant Valley, and Mound Pressure subareas nearer the coast is confined.

Malibu Unit

Only a portion of this unit, 52,540 acres, is covered in this report. The remainder of this hydrologic unit falls within the scope of Department of Water Resources Bulletin No. 24-60, "Coastal Los Angeles County Land and Water Use Survey, 1960". The unit lies in the southeast part of Ventura County and is bounded on the northwest by the southern boundary of the Santa Clara-Calleguas Hydrologic Unit. There are few streams and only minor urban and agricultural development in the Malibu unit.



Courtesy: Fairchild Aerial Surveys, Inc.

Location: Oxnard Plain

Los Angeles-San Gabriel River Unit

This unit is also covered only partially in this report, totaling 6,180 acres within the southeastern portion of Ventura County. A more detailed description of this entire hydrologic unit can be found in Bulletin No. 24-60, under the sections describing the San Fernando Hydrologic Unit.

San Joaquin Valley Unit

This area of 17,790 acres is located in the northern part of the study area and drains into the San Joaquin Valley. In order to complete a land and water use inventory on a countywide basis, this small area of the San Joaquin Valley lying within Ventura and Los Angeles Counties will be included in the tables and will be designated San Joaquin Valley Unit in this report. The area contains a small amount of urban-suburban and irrigated agriculture development, amounting to less than 1 percent of the total area within this unit.

Population

The first permanent settlement in the study area occurred when Father Junipero Serra established Mission San Buenaventura in 1782 on the site of present day Ventura. San Buenaventura became an incorporated city in 1866; officially, the city still retains its original name, although common usage has long since shortened it to "Ventura". The county itself was formed in 1873 as "Ventura County".

In 1930, Ventura County had a population of 55,000; by 1950, the county population had more than doubled to 114,600, while in 1960

the Bureau of Census found the population to be 199,138. Urban expansion in Ventura County has been very rapid during the past two decades. This can be attributed to a spillover of urban development from the Los Angeles metropolitan area into relatively undeveloped areas such as Conejo Valley and Simi Valley.

The populations of both Ventura County and the Los Angeles County portion of the Upper Santa Clara River Drainage Area for the census years 1930 through 1960, with an estimate for 1961, are presented in Table 3.

TABLE 3

HISTORICAL POPULATION OF VENTURA COUNTY AND
UPPER SANTA CLARA RIVER DRAINAGE AREA

Year	Population			
	Ventura	Upper Santa	Total	
	County ^a	Clara River	investigational	
		Drainage area ^b	area	
1930	54,976	3,287	58,263	
1940	69,685	5,620	75,305	
1950	114,647	10,269	124,916	
1960	199,138	18,362	217,500	
1961	212,200	17,900	230,100	

a. Values from U. S. Census Bureau publications.

b. Estimates from Los Angeles County Planning Commission.

The population in the Los Angeles County area of the investigation decreased somewhat between the years 1960 and 1961. A possible explanation for this population loss may be the cutback of defense contracts and closure of some aircraft industries in Antelope Valley.

Population increases in the study area from 1930 to 1961 are shown in Table 4; the population growth in Ventura County only for these years is graphically presented in Figure 1.

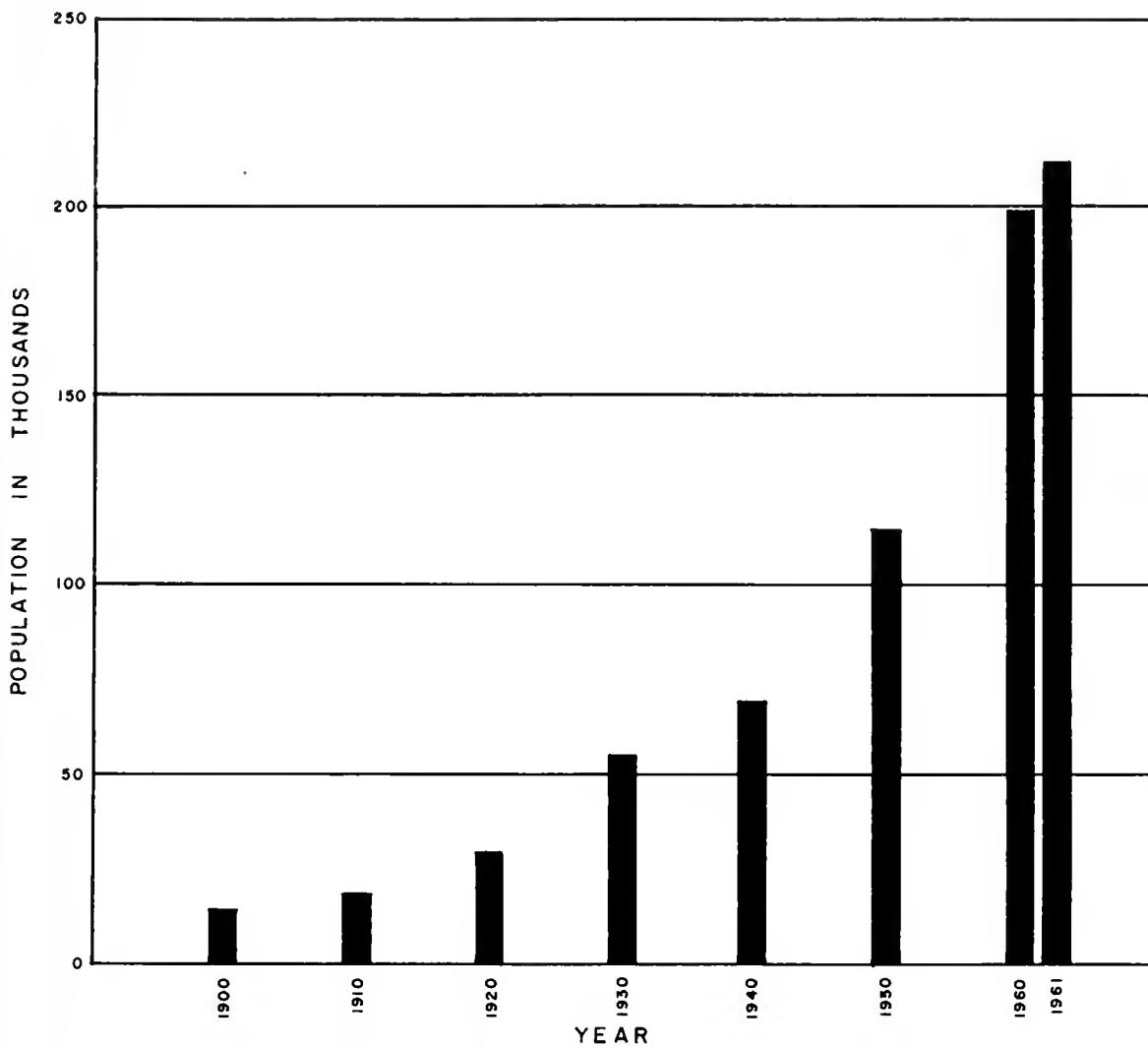


FIGURE I

In 1940 the City of Ventura had a greater population than Oxnard. But factors such as topography and proximity to military reservations caused the City of Oxnard to expand to a point where the population exceeded that of Ventura by over 11,000 in 1960.

Oxnard continues to be the largest incorporated city in the study area, with an estimated population of 42,200 in April of 1961. In ten years, 1950 to 1960, the population of Oxnard increased over 86 percent.

TABLE 4

POPULATION INCREASE IN VENTURA COUNTY AND
UPPER SANTA CLARA RIVER DRAINAGE AREA

Period	Area	Total increase		Average increase per year	
		Number	Percent	Number	Percent
1930-40	Ventura County	+ 14,709	+ 26.8	+ 1,471	+ 2.4
	Upper Santa Clara River Drainage Area*	+ 2,333	+ 71.0	+ 233	+ 5.5
	Total Investigational Area	+ 17,042	+ 29.3	+ 1,704	+ 2.6
1940-50	Ventura County	+ 44,962	+ 64.5	+ 4,496	+ 5.1
	Upper Santa Clara River Drainage Area*	+ 4,649	+ 82.7	+ 465	+ 6.2
	Total Investigational Area	+ 49,611	+ 65.9	+ 4,961	+ 5.2
1950-60	Ventura County	+ 84,491	+ 73.7	+ 8,449	+ 5.7
	Upper Santa Clara River Drainage Area*	+ 8,093	+ 78.8	+ 809	+ 6.0
	Total Investigational Area	+ 92,584	+ 74.1	+ 9,258	+ 5.7
1960-61	Ventura County	+ 13,062	+ 6.56	+ 13,062	+ 6.6
	Upper Santa Clara River Drainage Area*	- 441	- 2.40	- 441	- 2.4
	Total Investigational Area	+ 12,621	+ 5.80	+ 12,621	+ 5.8

* Los Angeles County portion only.

The growth of the six incorporated cities within Ventura County since 1940 is presented in Table 5.

TABLE 5
POPULATION OF INCORPORATED CITIES
WITHIN VENTURA COUNTY

City	Population ^a			
	1940	1950	1960	1961 ^b
Oxnard	8,519	21,567	40,265	42,200
Ventura	13,264	16,534	29,114	29,800
Santa Paula	8,986	11,049	13,279	13,900
Port Hueneme	400 ^b	3,024	11,067	11,650
Ojai	1,622	2,519	4,495	4,750
Fillmore	3,252	3,884	4,808	4,850

a. Values for census years obtained from U.S. Bureau of Census reports.

b. Estimated by Ventura County Planning Department.

The department has recently estimated in studies for water contracting purposes that the population of Ventura County will be 740,000 by the year 1980 (an average increase per year of 6.8 percent), and 1,100,000 by the year 1990 (an average increase per year of 5.9 percent). Should Ventura County maintain the same average increase per year (5.7 percent) exhibited for the 1950-60 period, the population in 1980 would still be over 600,000. The Ventura County Planning Department has estimated that the county population will reach 300,000 during 1964.

Urban and Suburban Development

An event which triggered one of the early developments in Ventura County was the construction in 1871 of a wharf at Port Hueneme to handle shipments of grain and wool. For several years Port Hueneme handled more shipping than any port in the south coastal area. Eventually

the port slipped into obscurity until 1942, when the Navy established a naval base for the newly organized "Seabees". The Construction Battalion Center caused a new flurry of residential development, which in turn caused rapid development of commercial enterprises.

Urban growth was further accelerated by the establishment of the Naval Air Missile Test Center at Point Mugu in 1946, followed by construction of the Oxnard Air Force Base near Camarillo. The period of military growth greatly affected the entire economy of the county; but dependence on military activity, which varied according to national needs, caused fluctuations in the local economy.

Oil production began as early as 1866, but major production was not reached until 1925 when rich fields were tapped north of the City of Ventura. Today, Ventura County is one of the three major oil producing counties in California. The Newhall area was also important to California's oil industry. This area produced the first truly commercial well and oil refinery in the State.

The residential, commercial, and industrial growth in Southern California has been quite spectacular in recent years resulting in a scarcity of vacant habitable land in coastal Los Angeles County. Urban expansion is now overflowing into Ventura County completely changing the pattern of land use. This overflow, along with a potential for industrial sites, provided the conditions which initiated a new phase in the county's economy. Light manufacturing and research industries have been rapidly moving into Ventura County and some parts of the Upper Santa Clara River Area resulting in an increased labor force and new residential and commercial construction around Conejo and Simi Valleys, Oxnard, Thousand Oaks, and Solemint. The

assessed valuation of Ventura County increased from \$241,824,130 in 1950-51 to \$508,266,940 in 1961-62. This growth amounts to a 110 percent increase. The growth of urban-suburban land use in Ventura County, based on surveys made in 1932, 1950, 1957, and 1961, is shown graphically in Figure 2.

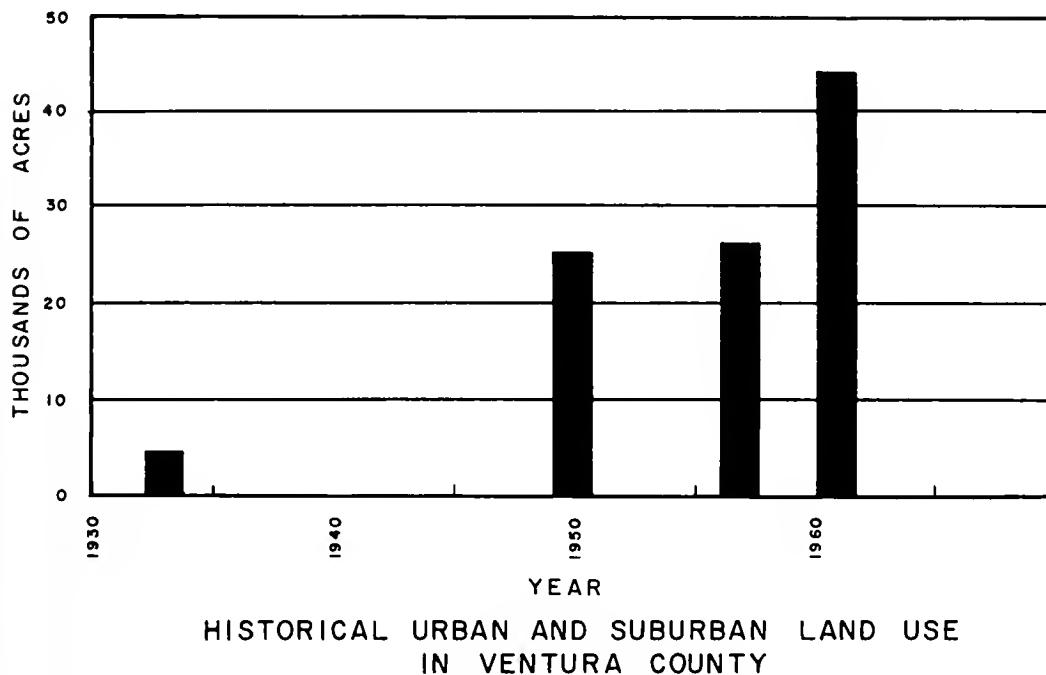


FIGURE 2

Agricultural Development

The first agricultural development in the study area began when Mission San Buenaventura was established in 1782. The mission fathers constructed irrigation systems to direct water to cultivated land around the mission. Soon afterward grants of large areas were made by the King of Spain to Spanish Californians. One of the largest grants in California was Rancho Simi, which covered a little over 113,000 acres. By the 1830's there were 19 ranchos in Ventura County covering nearly one-half million acres of grazing land for sheep and cattle. Drought coupled with a

Courtesy: Josef Muench

Location: Upper Ojai Valley

depression in cattle prices during the 1860's caused an end to the Rancho days, forcing the great ranchos to be divided.

The first commercial citrus grove in Ventura County was planted in 1874 near Santa Paula. In the decade from 1880 to 1890, the economy of Ventura County experienced a marked change with the introduction of large-scale irrigation in areas where water supplies were readily available. Walnuts were introduced to the Santa Clara River area about this time, and just prior to the turn of the century, large acreages in the Oxnard Plain were planted to beans. Over 14,000 acres of apricots were planted in Ventura County after 1900, which placed the county first in California in both acreage and production. During the 1920's, over 25,000 acres were devoted to the production of walnuts.

High land values coupled with increased cost of growing and harvesting crops has caused changes in the agricultural picture. Only a small acreage remains in apricots, and the walnut acreage is rapidly declining. Ventura County at one time was a leader in lima bean production, with some 60,000 acres under cultivation; but, as with apricots and walnuts, the acreage has declined steadily during the past few years, being replaced by urban development or more intensively farmed crops. At present, lemons, oranges and tomatoes are Ventura County's leading money crops, although green beans, celery, lettuce, lima beans, and strawberries have also added much to the agricultural wealth of the county.

The actual gross area of irrigated agriculture has changed very little since 1932 when the Division of Water Resources made its first land use survey of Ventura County for Bulletin No. 46. At that time, there were 109,500 acres of irrigated agriculture in the county. In 1950 another

survey was made for Bulletin Nos. 2 and 12 which recorded 115,200 acres. Present development (1961) of irrigated agriculture amounts to 116,300 acres. In comparing the above values it is evident that irrigated agriculture has not experienced any major changes in gross area during the past 30 years.

The Upper Santa Clara River Drainage area in Los Angeles County is not a major agricultural producer, but exceeds Ventura County in alfalfa production. Some truck and field crops are planted along the Upper Santa Clara River, while nonirrigated grain is planted on the surrounding hills.

Economic competition for agricultural land through increasing urbanization is forcing land values in the study area to rise. Increased agricultural production through technological advances and through such practices as double-cropping and triple-cropping are aiding the farmer; however, survival of agriculture in the investigational area will probably depend on improved farming methods and development of high-yield seed.

Water Supply

Before 1961, Ventura County and the Upper Santa Clara River area depended entirely on local water supplies. The three major water service agencies in Ventura County are Calleguas Municipal Water District, Ventura River Municipal Water District, and United Water Conservation District. The area along the Santa Clara River in Los Angeles County, until recently, has not been under the jurisdiction of any major water service agency, but has been limited to water service from individual farm operators, private water companies, and one public district. In April 1962, the Upper Santa

Clara Valley Water Agency was formed to serve a large part of this area with imported water from the California Aqueduct. Minor portions of the Antelope Valley-East Kern Water Agency, which was formed for the same purpose in 1959, are also included within the investigational area.

Before 1963, Calleguas Municipal Water District depended on pumping from overdrafted ground water basins to provide water service to a rapidly developing urban area. The district joined The Metropolitan Water District of Southern California in December 1960, and began service of imported Colorado River water in November of 1963.

The Ventura River Municipal Water District depends entirely on surface diversions for its water supply. The Robles Diversion Dam across the Ventura River diverts the flow of the Ventura River into the Robles-Casitas Canal which discharges into Casitas Reservoir, an offstream storage reservoir located on Coyote Creek. The diversion dam, canal, and Casitas Dam were constructed by the U. S. Bureau of Reclamation in 1959. Matilija Reservoir, located on Matilija Creek, acts as a temporary detention storage reservoir for operation of the Robles Diversion Dam and the Robles-Casitas Canal. Matilija Dam was built in 1949 by the Ventura County Flood Control District, and is now operated by the Ventura River Municipal Water District.

The United Water Conservation District depends on both surface storage and ground water. Runoff from Piru Creek is stored in the District's Lake Piru, and later released for percolation into depleted underground basins or for use as a surface supply. The major portion of the ground water utilization in Ventura County occurs on the Oxnard Plain. Aquifers underlying this area are recharged by spreading operations at the District's Piru, Saticoy, and El Rio spreading grounds.

The major water service agencies in Ventura County and the Upper Santa Clara River area in Los Angeles County are shown on Plate 3, "Major Water Agencies".

Local Water Supply

The local water supplies in Ventura County and the Upper Santa Clara River Drainage Area have been estimated by the Department of Water Resources and its predecessor agencies and have been reported in prior reports. State Water Resources Board Bulletin No. 12, "Ventura County Investigation", reported the safe yield of local water supplies in Ventura County, as developed for the base period 1936-37 through 1950-51, to be 107,100 acre-feet per year. This value included average seasonal imports of 2,100 acre-feet of Santa Clara River water from Los Angeles County. The safe yield of the Upper Santa Clara River Drainage Area in Los Angeles County was estimated for Department of Water Resources Bulletin No. 78, "Investigation of Alternative Aqueduct Systems to Serve Southern California". The estimate was approximately 35,000 acre-feet per year exclusive of the above-mentioned 2,100 acre-feet exported to Ventura County.

Since Bulletin No. 12 was published, both Casitas Reservoir and Lake Piru have become operational, further adding to local water supplies. The safe yield of local water supplies in Ventura County was estimated to be 148,900 acre-feet annually by 1960 in Bulletin No. 78. Therefore, the nominal safe yield of local water supplies in 1960 for the entire investigational area was approximately 183,900 acre-feet annually.

More recent estimates by the Department of Water Resources as part of feasibility studies leading to contracts for service from the

State Water Project indicate that available local water supplies in 1961 for the entire investigational area amounted to about 186,300 acre-feet annually. According to a reconnaissance appraisal by the Bureau of Reclamation of opportunities for development of additional water supplies in Ventura County, this value could be increased by 27,500 acre-feet annually by the construction on Sespe Creek of Topatopa and Cold Spring Dams, together with appurtenant diversion structures and delivery conduits. No significant additional water supply development in the Upper Santa Clara River area is believed possible.

Imported Water

Local areas of Ventura County and the Upper Santa Clara River Valley have experienced water shortages during the current 20-year drought, and with the present and anticipated rapid growth, water conditions may become critical, especially if the period of subnormal precipitation continues.

To help alleviate these water shortages, the Calleguas Municipal Water District, including the City of Oxnard, joined The Metropolitan Water District of Southern California and commenced importing Colorado River water to Simi Valley in November 1963. It is estimated that importation during the first 12 months will be about 900 acre-feet per month. Existing facilities can accommodate a flow of 100 cfs. In addition, the Upper Santa Clara Valley Water Agency has contracted with the State of California for a maximum annual supply of 26,500 acre-feet and the Ventura County Flood Control District for 20,000 acre-feet from the California Aqueduct. Deliveries to these two agencies are scheduled to start in 1972, gradually

increasing to the foregoing full entitlements in 1990. Although the Antelope Valley-East Kern Water Agency has contracted for 138,400 acre-feet of California Aqueduct water, only a very minor portion of this agency is within the investigational area, and little of this water is expected to be available within that area.

Sewage and Industrial Waste Disposal

Discharges to cesspools and septic tanks constitute the principal method of disposal of sewage in Ventura County and the Upper Santa Clara River area. The only sewage treatment plants discharging large quantities of sewage effluent to streams or percolation ponds are those of the Cities of Fillmore, Ojai, and Santa Paula, the town of Camarillo, Camarillo State Hospital, and the Wayside Honor Rancho.

The range in flows from these treatment plants during 1960-61 averaged from 368 acre-feet (the output of the City of Fillmore) to over 1,000 acre-feet (discharge from the Santa Paula Plant). There are several other disposal plants within the investigational area, but production is comparatively small. In 1960-61, the Cities of Oxnard, Ventura, and Port Hueneme, along with coastal naval facilities, discharged approximately 8,900 acre-feet of treated sewage through outfalls to the ocean.

Industries in Ventura County that produce quantities of waste containing relatively high concentrations of dissolved minerals include the petroleum industry; citrus, walnut, and vegetable processing and packing plants; and water softener companies. Degradation of ground water has occurred in some cases where disposal sites are inland, but in many instances measures have been taken to correct improper discharge practices.

Methods of waste disposal are varied and include discharge to the ocean or riverbed both directly and through sewers, discharge through seepage sumps and by injection to unconfined ground water basins. More detailed data regarding waste disposal and reclamation may be obtained from Department of Water Resources Bulletin No. 75 entitled "Water Quality and Water Quality Problems, Ventura County".



Location: Upper Santa Clara Valley
Courtesy: Spence Air Photos

CHAPTER III. LAND USE

The type, location, and areal extent of present land use within the study area were determined by a detailed land use survey conducted during the summer of 1961. The results of that survey are presented in this chapter, along with a discussion of methods and procedures. Comparisons of land use found during the 1961 survey and during previous surveys are also presented.

Methods and Procedures

Mapping of land use in Ventura County and the Upper Santa Clara River area of Los Angeles County was initiated in June 1961 by department field crews who delineated the various land use types on recent aerial photographs. In the office, these field delineations were transferred by projection to reproducible prints of United States Geological Survey quadrangle maps at a scale of 1:24,000. These maps served as area control maps, insuring the accuracy of the succeeding processes, while the reproducible prints served as masters for reproducing land use delineations on vellum prints. The individual areas of land use types were cut from the vellum prints and weighed, and by electronic data processing machines these weights were converted into total acreages of individual land use types.

For purposes of a critical hydrologic analysis, it would be desirable to determine and compile the types of land use, both developed and undeveloped, for the entire area of the hydrologic unit, permitting a comprehensive analysis and evaluation of the various levels of water use for the entire area. However, the additional expense incurred in making

such a complete compilation is not felt to be warranted at present; therefore, only those areas which are underlain by water-bearing material are mapped in their entirety. In those areas which are not underlain by water-bearing material, only types of land use requiring applied water are mapped. All other types of land use in areas not underlain by water-bearing material are tabulated in a category called "Unclassified".

Classification of Land Use

For purposes of analysis and presentation, the various land uses are grouped into two major categories under water service areas: (1) Urban and Suburban, and (2) Irrigated Agriculture; and into three major categories under nonwater service areas: (1) Nonirrigated Agriculture, (2) Native Vegetation, and (3) Unclassified. The major categories under water service areas each include several classes of land use, and these several classes consist of various types of land use. The objective of this classification procedure is to group the various types of land use into classes requiring similar unit amounts of water.

The major categories, specific classes and types of land use included in the classification are as follows:

WATER SERVICE AREA

Urban and Suburban Category

<u>Class of Land Use</u>	<u>Type of Land Use</u>
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Residential	Single and multiple family houses and apartments, recreational areas, rest homes, trailer parks, and residential subdivisions under construction at time of survey.
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Commercial All classes of commercial enterprises, including strip commercial and downtown commercial areas, schools, and hospitals.

Industrial All classes of industrial land use involving manufacturing, processing, packaging, storage and distribution facilities, but excluding extractive industries (oil, sand, and gravel).

Unsegregated urban and suburban area Farmsteads, dairies, livestock ranches, parks, cemeteries, and golf courses.

Included nonwater service area Oil fields, tank farms, vacant lots, quarries, gravel pits, public streets, landing strips of air fields, and miscellaneous paved areas.

Irrigated Agriculture Category

<u>Class of Land Use</u>	<u>Type of Land Use</u>
Alfalfa	Alfalfa raised for hay, seed, or pasture.
Pasture	Irrigated grasses and legumes other than alfalfa used for livestock forage.
Citrus and Subtropical	Oranges, lemons, grapefruit, avocados, olives, and miscellaneous subtropical fruits.
Truck crops	Vegetables of all varieties, melons, flower seed, all types of beans and nursery crops.
Field crops	Cotton, flax, sorghums, sugar beets, and field corn.
Deciduous fruits and nuts	All varieties of deciduous fruits and nuts, including vineyards.
Small grains	Barley, wheat and oats.

Fallow Tilled, between crops.

Included nonwater service area Public highways and roads, farm access roads, canals, and other inclusions not devoted to crop production, including idle and abandoned lands.

NONWATER SERVICE AREA

Type of Land Use

Nonirrigated Agriculture Category . All varieties of dry-farmed crops, including pasture, overlying defined ground water basins.

Native Vegetation Category Native grasses, brush and trees, including phreatophytes, overlying defined ground water basins.

Unclassified Category Bare ground, including river washes, beaches, and water surfaces overlying defined ground water basins; and non-irrigated agriculture and native vegetation not overlying defined ground water basins.

The classes of land use defined here are similar to those used in Bulletin No. 2, except that schools, included in "Unsegregated Urban and Suburban Area", in Bulletin No. 2 are herein classified as "Commercial"; in addition, parks, golf courses, and cemeteries, classified as "Irrigated Pasture" in Bulletin No. 2, are included under "Unsegregated Urban and Suburban Area" in this report.

In delineating land use classes in the field, no attempt was made to exclude such items as streets, roads, railroads, powerline rights-of-way, and other essentially nonwater-using lands occurring within the surveyed areas. Instead, these land uses were classified as "Included Nonwater Service Area", and were extracted from gross land use totals by

applying to each major land use class a percentage value appropriate for that class. Reduction factors were derived by analyzing the area in streets, roads and rights-of-way within field delineated parcels of land use. These nonwater-using areas were then compared to the gross delineation in order to derive the reduction percent. The major classes of land use and appropriate reduction factors are presented in Table 6. The net acreage values used in the tables summarizing land use represent the gross acreage values minus those portions of the gross values which have been deducted for these "Nonwater Service Areas".

TABLE 6
FACTORS FOR REDUCTION OF GROSS AREAS
TO NET WATER SERVICE AREAS

Land use	:	Percent deducted from gross area
Residential		20
Commercial		30
Industrial manufacturing		25
Schools		15
Parks, cemeteries, and golf courses		15
Feedlots, dairies		5
Farmsteads		15
Irrigated agriculture		5

Results of Land Use Survey

Data derived from the 1961 land use survey are compiled in Table 7 according to hydrologic units, and in Table 8 by counties. In Appendix E, these data are presented according to the hydrologic units, subunits, and subareas delineated on Plate 2. These tables show that at the time of the survey the gross acreage requiring water service within the area of investigation was about 176,240 acres; of which 123,490 acres,

TABLE 7

LAND USE IN HYDROLOGIC UNITS OF VENTURA COUNTY AND
UPPER SANTA CLARA RIVER DRAITAGE AREA, 1961

In acres

Category and class of land use	Santa Maria ^a Cuyama ^a	Santa Ynez ^a	Santa Barbara ^a	Rincon Creek ^a	Ventura River ^a	Santa Clara- Callenguas ^a	Hydrologic units		Los Angeles: San Gabriel: River ^a	San Joaquin: Valley ^a	Totals
							Santa Maria ^a Cuyama ^a	Santa Ynez ^a	Santa Barbara ^a	Rincon Creek ^a	
<u>WATER SERVICE AREA</u>											
Urban and Suburban											
Residential	20	0	0	60	2,970	10,850	90	20	10	14,020	
Commercial	10	0	0	0	550	2,300	30 ^b	0	10 ^b	2,900	
Industrial	0	0	0	50	380	1,880	10 ^b	20	20	2,320	
Unsegregated urban and suburban area	70	0	10	30	710	5,230	90	—	—	6,160	
Subtotals	100	0	10	140	4,610	20,260	210	30	40	25,400	
Included Non-water Service Area	30	0	— ^b	1,320	4,820	20,950	120	90	20	27,350	
Gross Urban and Suburban Area	130	0	10	1,460	9,430	41,210	330	120	60	52,750	
<u>IRRIGATED AGRICULTURE</u>											
Alfalfa	60	0	0	0	40	4,110	20	— ^b	50	4,280	
Pasture	20	0	0	0	260	2,700	220	0	20	3,220	
Citrus and subtropical	0	0	180	0	2,610	48,460	10	0	0	51,260	
Truck crops	0	0	0	40	40	42,210	10	0	0	42,300	
Field crops	0 ^b	0	0	0	0	1,470	70	0	0	1,540	
Deciduous fruits and nuts	0	0	0	0	690	7,220	0	0	0	7,910	
Small grains	0	0	—	0	50	250	0	0	0	300	
Subtotals	80	0	180	40	3,690	106,420	330	0	70	110,840	
Fallow	10 ^b	0	0	90 ^b	10	5,050	20	0 ^b	0 ^b	5,180	
Included Non-water Service Area	—	0	10	—	250	7,230	10	—	—	7,500	
Gross Irrigated Agriculture	20	0	190	130	3,950	118,700	360	0	70	123,490	
GROSS WATER SERVICE AREA	220	0	200	1,590	13,380	159,910	690	120	130	176,240	
<u>NONWATER SERVICE AREA</u>											
Nonirrigated Agriculture	1,000	0	0	0	2,670	19,750	2,140	0	510	26,070	
Native vegetation	50,400	0	0	420	8,910	176,440	1,350	0	2,340	239,860	
Unclassified	108,260	1,670	9,210	12,000	125,520	930,370	48,360	6,060	14,810	1,253,960	
GROSS NONWATER SERVICE AREA	159,660	1,670	6,910	12,420	137,100	1,126,560	51,850	6,060	17,660	1,519,860	
TOTALS	159,380	1,670	7,110	14,010	150,480	1,286,470	52,540	6,180	17,790	1,696,130	

a. Partial unit, remainder outside investigation area.
b. Less than five acres.

TABLE 8

LAND USE BY COUNTIES IN VENTURA COUNTY AND
UPPER SANTA CLARA RIVER DRAINAGE AREA IN 1961

In Acres

Category and Class of Land Use	In Acres	Ventura	Los Angeles	Kern	Santa Barbara	Totals
<u>WATER SERVICE AREA</u>						
Urban and Suburban						
Residential	12,540	1,480	*	0	0	14,020
Commercial	2,450	450	0	0	0	2,900
Industrial	1,840	480	0	0	0	2,320
Unsegregated urban and suburban area	<u>4,260</u>	<u>2,900</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>6,160</u>
Subtotals	21,090	4,310	*	0	0	25,400
Included Nonwater Service Area	<u>22,910</u>	<u>4,440</u>	*	0	0	<u>27,350</u>
Gross Urban and Suburban Area	44,000	8,750	*	0	0	52,750
<u>Irrigated Agriculture</u>						
Alfalfa	1,420	2,860	0	0	0	4,280
Pasture	2,250	970	0	0	0	3,220
Citrus and subtropical	51,260	0	0	0	0	51,260
Truck crops	40,660	1,640	0	0	0	42,300
Field crops	1,190	350	0	0	0	1,540
Deciduous fruits and nuts	7,410	500	0	0	0	7,910
Small grains	<u>290</u>	<u>10</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>300</u>
Subtotals	104,480	6,330	0	0	0	110,810
Fallow	4,790	390	0	0	0	5,180
Included Nonwater Service Area	<u>7,000</u>	<u>500</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>7,500</u>
Gross Irrigated Agriculture	<u>116,270</u>	<u>7,220</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>123,490</u>
<u>GROSS WATER SERVICE AREA</u>						
NONWATER SERVICE AREA	160,270	15,970	*	0	0	176,240
Nonirrigated Agriculture						
Native vegetation	17,870	8,200	0	0	0	26,070
Unclassified	150,400	89,440	20	0	0	239,860
	<u>851,430</u>	<u>389,770</u>	<u>7,330</u>	<u>0</u>	<u>0</u>	<u>1,253,960</u>
GROSS NONWATER SERVICE AREA	<u>1,019,700</u>	<u>487,410</u>	<u>7,350</u>	<u>5,430</u>	<u>0</u>	<u>1,519,890</u>
TOTALS	1,179,370	503,380	7,350	5,430	1,696,130	

*Less than 5 acres.

or about 70 percent, were devoted to irrigated agriculture, while urban-suburban development amounted to 52,750 acres.

Detailed information concerning the pattern of land use as determined from this survey may be found on Plates 4A and 4B, "Present Land Use". Although the acreages of nonwater service areas within urban-suburban and irrigated agricultural areas are listed separately on the summary tables, they were not shown on the plates. Also excluded from the plates were developed nonwater service lands, such as nonirrigated agriculture, and undeveloped nonwater service lands, such as native vegetation.

A tabulation of 1961 land use within major water service agencies in Ventura County and the Upper Santa Clara River area is presented in Table 9. Although the Upper Santa Clara Valley Water Agency was not formed until 1962, its importance to future planning warrants its inclusion in this table.

About 572,780 acres, 34 percent of the investigational area, lie within five present water service districts, but these districts serve 96 percent (169,620 acres) of the gross water service area (176,240 acres) within the scope of this study. Approximately 48,500 acres of the gross water service area within these districts are devoted to urban-suburban use, whereas 121,120 acres are in irrigated agriculture. Of the 169,620 acres of gross water service area served by these districts, the United Water Conservation District accounts for almost 60 percent; Calleguas Municipal Water District, 24 percent; Ventura River Municipal Water District, 9 percent; the Upper Santa Clara Valley Water Agency, 7 percent; and the Antelope Valley-East Kern Water Agency, less than one-half of one percent. A very large portion (11,250 acres) of the gross water service

TABLE 9
LAND USE IN SERVICE AREAS OF MAJOR WATER AGENCIES OF VENTURA COUNTY
AND UPPER SANTA CLARA RIVER DRAINAGE AREA IN 1961

In acres

Category and class of land use	United Water Conservation District						Municipal Water Districts					
	Santa Clara : River : Valley	Colonial ^a : Unit	Del Norte ^b : Unit	Oxnard : Unit	Ocean View ^c : Unit	Oxnard : Unit	Pleasant Valley : Unit	U. S. Naval : Center	Mission : Unit	Total : District	Ventura : Colleged ^d	Santa Clara : River
<u>WATER SERVICE AREA</u>												
Urban and suburban												
Residential	1,360	0	30	1,000	20	2,760	0	130	5,400	3,720	3,190	860
Commercial	280	0	60	10	190	20	660	60	1,200	680	320	100
Industrial	330	50	30	40	70	20	460	50	1,170	200	450	20
Unegregated urban and suburban area	560	40	110	60	200	70	340	70	4,490	1,650	370	0
Subtotal	2,530	90	230	210	1,640	130	4,220	350	9,350	6,660	5,080	1,410
Included Nonwater Service Area	<u>3,650</u>	<u>50</u>	<u>400</u>	<u>320</u>	<u>840</u>	<u>190</u>	<u>3,400</u>	<u>620</u>	<u>10,240</u>	<u>5,620</u>	<u>6,170</u>	<u>2,520</u>
Gross Urban and Suburban Area	6,220	140	630	530	2,350	320	7,620	750	10,030	19,590	11,250	5,480
Irrigated Agriculture												
Alfalfa	220	0	0	120	0	0	0	160	0	500	680	40
Pasture	750	0	190	30	80	220	0	60	0	1,330	360	260
Citrus and subtropical	22,080	510	3,500	1,830	3,280	2,640	890	700	35,600	11,940	2,810	0
Truck crops	2,890	2,470	4,500	3,600	2,210	4,080	3,940	9,610	70	33,460	7,110	80
Field crops	200	0	100	40	160	0	10	110	0	4,620	4,620	10
Deciduous fruits and nuts	410	40	530	90	110	0	20	0	1,180	5,200	700	40
Small grains	0	0	0	0	0	0	0	10	0	230	60	0
Subtotal	26,550	3,020	9,000	5,670	5,840	6,940	4,870	10,660	160	72,710	26,010	3,960
Fallow	270	640	630	200	250	510	540	400	0	3,620	1,040	100
Included Nonwater Service Area	<u>1,730</u>	<u>160</u>	<u>500</u>	<u>300</u>	<u>330</u>	<u>660</u>	<u>270</u>	<u>4,410</u>	<u>20</u>	<u>2,260</u>	<u>250</u>	<u>450</u>
Gross Irrigated Agriculture	28,250	3,820	10,130	6,420	7,390	5,690	11,810	180	80,780	29,340	4,210	6,700
GROSS WATER SERVICE AREA	34,770	3,960	10,760	6,790	8,770	8,210	13,300	12,560	1,210	100,330	40,990	15,560
NONWATER SERVICE AREA												
Nonirrigated Agriculture												
Native vegetation	740	80	350	0	80	50	80	20	10	1,410	8,840	2,640
Unclassified	18,510	1,040	2,060	10	920	980	370	160	1,060	25,110	39,700	9,270
GROSS NONWATER SERVICE AREA	<u>75,040</u>	<u>900</u>	<u>2,760</u>	<u>0</u>	<u>270</u>	<u>230</u>	<u>1,120</u>	<u>170</u>	<u>6,000</u>	<u>86,490</u>	<u>87,410</u>	<u>28,450</u>
TOTALS	129,060	5,980	15,930	6,800	10,040	9,470	14,870	12,910	8,280	213,340	176,940	85,640
											78,760	18,140

^a Boundary corresponds to Colonial Municipal Water District.

^b Boundary corresponds to Del Norte Municipal Water District.

^c Boundary corresponds to Ocean View Municipal Water District.

^d Member of Metropolitan Water District of Southern California.

e. Agency formed April 1962.

area (15,560 acres) of the Ventura River Municipal Water District is in urban-suburban types of land use. Almost all of the water service area within the boundaries of the Antelope Valley-East Kern Water Agency lies outside the present investigational area.

Changes in Land Use

The ideal comparison of land use would be made on the basis of hydrologic units with unchanged boundaries, but historical data have not been reported by such units for the entire investigational area. Bulletin No. 12 listed 1950 land use by hydrologic units, but the listed units covered only the southern half of Ventura County. The only report that could be compared easily was Bulletin No. 2, which reported 1950 land use by hydrographic units. It was found that groupings of 1961 hydrologic units could satisfactorily be compared to 1950 hydrographic units, and that variations in the boundaries involved negligible amounts of land use. The comparison of Hydrographic Unit 1 of Bulletin No. 2 involved the grouping of the Ventura River and Rincon Creek Hydrologic Units of this report, while the entire Santa Clara-Calleguas Hydrologic Unit was found to be comparable to Hydrographic Unit 2 of Bulletin No. 2.

Changes in land use in the area of investigation between 1950 and 1961 are indicated in Table 10. Acreages of the various classes of land use on the basis of hydrographic units, determined from surveys made in 1950 and 1961, are listed in this table. The 1961 land use grouped by these hydrographic units accounts for 86 percent of the present investigational area. The remaining area not covered in the comparison includes only 1,360 acres of water service area, or not quite one percent of the

TABLE 10

COMPARISON OF 1950 AND 1961 LAND USE IN VENTURA COUNTY AND
UPPER SANTA CLARA RIVER DRAINAGE AREA BY HYDROGRAPHIC UNITS

In acres

Category and Class of Land Use	Hydrographic		Hydrographic		Totals
	Unit 1	1961	Unit 2	1961	
<u>WATER SERVICE AREA</u>					
Urban and Suburban					
Residential	1,600	3,000	4,000	10,900	5,600
Commercial	300	600	900	2,200	1,200
Industrial	400	400	400	1,900	800
Unsegregated urban and suburban area	400	700	3,000	5,200	3,100
Subtotals	2,700	4,700	8,300	20,200	11,000
Included Nonwater Service Area	4,800	6,100	13,500	21,000	18,300
Gross Urban and Suburban Area	7,500	10,800	21,800	41,200	29,300
<u>Irrigated Agriculture</u>					
Alfalfa	200	300	8,600	4,100	8,800
Pasture	300	2,600	1,400	2,700	1,700
Citrus and subtropical	2,400	2,000	40,500	48,400	42,900
Truck crops	0	0	43,500	42,200	43,700
Field crops	800	700	400	1,400	400
Deciduous fruits and nuts	0	100	17,900	7,200	18,700
Small grains			800	200	800
Subtotals	3,900	3,800	113,100	106,200	117,000
Fallow	b	100	b	5,000	b
Included Nonwater Service Area	200	300	5,200	7,200	6,100
Gross Irrigated Agriculture	4,100	4,200	119,000	118,400	123,100
GROSS WATER SERVICE AREA	11,600	15,000	140,800	159,600	152,400
					174,600

- a. Less than 50 acres.
 b. Value not available.

total water service area. The data thus reported in the change of land use table will essentially represent changes in the entire 1961 investigational area.

The data indicate that during the period between the surveys, the gross area requiring water service increased 22,200 acres, from 152,400 acres to 174,600 acres or about 15 percent. The gross urban-suburban water service area increased by 22,700 acres or more than 77 percent, while the gross irrigated agricultural water service area decreased by 500 acres, a little less than one-half of one percent.

The changes which have occurred in the uses of land in the investigational area are delineated on Plate 5, "Major Changes in Land Use, 1950 to 1961".

Hydrographic Unit 1 (Ventura River and Rincon Creek Hydrologic Units)

The gross urban and suburban area increased from 7,500 acres in 1950 to 10,800 acres in 1961, about 44 percent. The residential area increased 88 percent while commercial land use increased 100 percent. The water-using industrial acreage remained unchanged. Nonwater-using industrial areas, such as oilfields and tank farms, have been included with other land use types in the category called "Included Nonwater Service Area". Any increase in this nonwater-using industrial area has no effect on water use, and cannot be determined from Table 10, but a cursory examination and field surveys indicate that the area of extractive industries has increased since 1950.

Gross irrigated agriculture made only a slight gain in acreage between the two survey years. The 4,100 acres recorded in 1950 increased



1951

*Changes in Land Use
City of Ventura*



1962

Courtesy: Spence Air Photos

Courtesy: Fairchild Aerial Surveys, Inc.

to 4,200 acres in 1961, a gain of about two percent. The acreages of small grains and also citrus and subtropical fruits increased, while acreages of alfalfa, truck crops, and deciduous fruits and nuts decreased.

Hydrographic Unit 2 (Santa Clara-Calleguas Hydrologic Unit)

Gross urban and suburban area in this unit increased from 21,800 acres in 1950 to 41,200 acres in 1961, or about 89 percent. All categories of urban and suburban land use increased by considerable amounts, ranging from a 73 percent gain in unsegregated urban-suburban area to an approximate 375 percent increase in industrial land use. The reduction in gross irrigated agriculture was negligible; nevertheless, the crop pattern has changed since 1950. Citrus and subtropical fruits have increased in acreage, while acreages in deciduous fruits and nuts have decreased sharply. Field crops and pasture have expanded while alfalfa and small grains experienced a considerable acreage loss. The area in truck crops remained relatively unchanged.

Future Land Use Trends

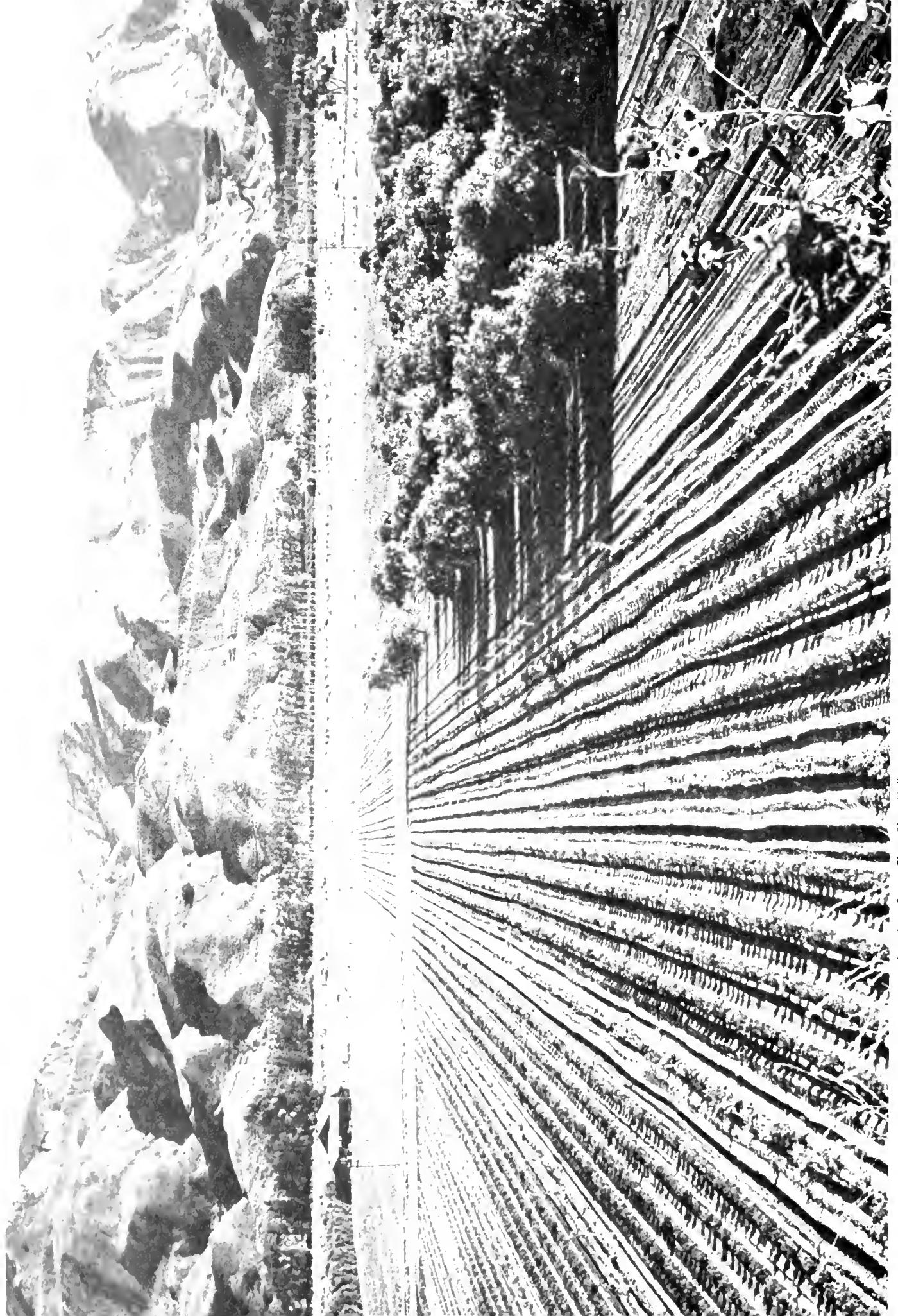
A determination of the amount and location of lands considered susceptible to intensive water-using development in Ventura County was made in connection with studies by the department for water contracting purposes. Gross urban-suburban acreage in Ventura County was estimated to be 134,000 acres by the year 1990. When this figure is compared with the 1961 county gross urban-suburban value of 44,000 acres, it is evident that a considerable area remains to be developed. The forecast for irrigated agriculture indicates a steady decline in acreage to the year 1990,

when it is estimated there will be a gross irrigated area of 56,000 acres, a 52 percent reduction of the 1961 surveyed gross area of 116,270 acres in the county.

Values for projected land use presented in California State Department of Water Resources Bulletin No. 119-18, "Feasibility of Serving the Upper Santa Clara Valley Water Agency from the State Water Project", indicate that all present irrigated and nonirrigated agricultural acreage within the boundaries of the Upper Santa Clara Valley Water Agency will be devoted to urban-suburban land uses by 1990. The dramatic change in land use occurring within the boundaries of this agency, which contains 76 percent of the present gross water service acreage within the Los Angeles County portion of the investigational area, is an indication of the future urban-suburban growth that will occur in the Upper Santa Clara Valley in Los Angeles County.

Courtesy: Josef Muench

Location: Santa Clara River Valley



CHAPTER IV. WATER USE

Land areas occupied by various types of water-using development in Ventura County and Upper Santa Clara River area, described in Chapter III, and appropriate unit values of water use were employed in this investigation to estimate the 1961 level of water use. This chapter presents the estimates of water use so derived, and the change in water use since previous estimates were made. Also presented is a discussion of the relationships between estimated levels of water use and available water supplies.

Definition of Water Use

The term "water use" is employed in the broadest sense to include all uses of water by nature under native conditions, and by man-made modifications of those natural conditions. It implies the application of water to any one, or all, of innumerable kinds of uses, both consumptive and nonconsumptive.

Consumptive use includes the water from any source utilized in the process of vegetative growth, such as transpiration and the building of plant tissue, and the water evaporated from the soil around the plant and foliage, as well as from water surfaces. It also includes the water consumed or evaporated by urban and nonvegetative types of land use.

In addition to the consumptive use of water, as defined above, there may be irrecoverable losses incidental to such use. These irrecoverable losses include such items as disposal or seepage of the unconsumed water to bodies of unsuitable quality, including the ocean, and

disposal or seepage of the unconsumed water in such a manner as to be uneconomical to recapture for use.

The water for consumptive use is obtained from two general sources: natural sources, including direct precipitation and surface runoff, and, as a special case, from a high ground water table; and man-developed sources, that is, water applied through the activities of man. Water furnished from this latter source is termed "applied water".

Man applies water to satisfy the requirement for consumptive use in excess of the amount supplied from natural sources. However, as a practical matter, the quantity of water applied is usually in excess of the consumptive use of applied water, and that portion of the water applied to any use that is not consumed or irrecoverably lost remains a part of the water supply.

In evaluating the overall needs for water in an area, it is necessary to determine the portion of the applied water that is consumptively used. That portion of the applied water that is consumptively used and irrecoverably lost is known as the "net water use". The difference between the applied water and the net water use is the amount of applied water that is subject to reuse as a part of the common supply.

Methods of Estimating Water Use

It follows from the previous discussion that in areas where none of the applied water becomes available for reuse, it is possible to determine the net water use directly by measuring the total water applied. On the other hand, in areas where a portion of the applied water becomes available for reuse, economic and technological limitations generally

preclude measurement of the volume of return flow of reusable water.

The net water use in these areas must be determined in another manner; therefore, an indirect method is used.

Using the indirect method commonly employed, estimates of net water use are obtained by multiplying the areas of the various classes of water-using developments by appropriate average values of consumptive use of applied water. These unit values of consumptive use of applied water reflect average conditions of precipitation and the normal practices associated with urban water distribution and with irrigated agriculture. Variations from normal or average in these factors during the specific year that a land use survey is conducted may result in a difference between the estimated and actual water use during that year. Such variations in 1950 and 1961 in the study area will be discussed later in this chapter. Despite the possibility of these variations, it is considered that the procedures used in this survey are adequate, and that the figures on current levels of water use are reasonable. Furthermore, it is believed that these estimates of net water use are sufficiently sound to permit their use in determining the adequacy of presently available water supplies and in planning for such additional supplies as will be necessary to meet current or expected future deficiencies.

Unit Values of Water Use

During this investigation, urban and suburban unit values of water use derived in Bulletin Nos. 2 and 12 were reviewed in order to determine the applicability of these values to 1961 conditions of development. The results of this review indicate that urban-suburban mean

seasonal unit values derived in Bulletin No. 2 for the Metropolitan Los Angeles area are applicable to the 1961 land use within the investigational area.

Agricultural unit values of water use were derived from data developed for Bulletin Nos. 2, 12, and 24. A complete discussion of the techniques employed in the derivation of units of water use is contained in Bulletin No. 2; therefore, only a general description of those procedures is set forth herein.

Urban and Suburban Water Use Values

Mean seasonal unit values of consumptive use of water on urban and suburban lands in the Los Angeles area were assumed to be applicable to the present study. These values were derived from (1) estimates of the consumptive use on the area occupied by impervious cover, bare lands, lawns, shrubs, etc.; and (2) estimates of other urban consumptive uses, such as household uses, etc. The mean seasonal unit values of consumptive use so determined and delivery of water are presented in Table 11. The consumptive use values shown on Table 11 were utilized to compute net water use in areas of the investigation where applied water in excess of consumptive use is generally considered to be available for reuse through deep percolation or salvage.

Mean seasonal unit values of delivery of water to urban and suburban types of land use, derived for the Los Angeles study and used in this report, were estimated from surveys which determined total water deliveries to known areas occupied by the various types of land use. These unit values of water delivery were utilized to compute net water use

TABLE 11

ESTIMATED MEAN SEASONAL UNIT VALUES OF CONSUMPTIVE USE AND
DELIVERY OF WATER ON URBAN AND SUBURBAN LANDS IN
VENTURA COUNTY AND UPPER SANTA CLARA RIVER DRAINAGE AREA

In feet

Land use type	: Consumptive use of : : applied water : :	Delivery
Residential, single	1.3	2.6
Residential, multiple	0.3	4.5
Residential, rural	0.8	1.8
Commercial strip	0.4	3.4
Industrial manufacturing	1.4	9.2
Schools	0.4	0.9
Dairies	1.0	1.9
Livestock and poultry ranches	0.6	1.3

in the areas where applied water in excess of consumptive use is generally not considered available for reuse.

Irrigated Agriculture Water Use Values

Unit seasonal values of consumptive use of water by irrigated crops were derived by a modification of the method developed for the U. S. Department of Agriculture by Harry F. Blaney and Wayne D. Criddle. The increased use of water resulting from multiple cropping practices of truck crops and beans was considered in estimating average unit values of applied water use. The values thus derived are presented in Table 12.

The values shown in Table 12 represent estimates of the average consumptive use of applied water and precipitation by the various types of irrigated agriculture. Bulletin No. 12 indicated that an average irrigation efficiency of about 70 percent was being achieved in the investigational area, and this value was utilized to estimate total use of applied

TABLE 12

ESTIMATED MEAN SEASONAL UNIT VALUES OF CONSUMPTIVE
USE OF WATER ON IRRIGATED LANDS, VENTURA COUNTY
AND UPPER SANTA CLARA RIVER DRAINAGE AREA

In feet of depth per unit of area

Units and subunits	Alfalfa	Pasture	Citrus and sub-tropical	Truck crops	Field crops	Deciduous	Walnuts	Small grain	Beans	Nursery
<u>Santa Maria-Cuyama Hydrologic Unit</u>										
<u>Cuyama Valley Subunit</u>										
Applied water	2.8	2.8	--	1.7	1.5	1.6	--	0.5	--	--
Precipitation	0.7	0.7	--	0.7	0.7	0.7	--	0.7	--	--
TOTAL	3.5	3.5	--	2.4	2.2	2.3	--	1.2	--	--
<u>Santa Ynez Hydrologic Unit</u>										
<u>Headwater Subunit</u>										
Applied water	2.1	2.2	1.1	1.5	1.5	1.5	--	0.7	--	--
Precipitation	1.2	1.1	1.1	1.0	1.0	1.1	--	1.0	--	--
TOTAL	3.3	3.3	2.2	2.5	2.5	2.6	--	1.7	--	--
<u>Santa Barbara Hydrologic Unit</u>										
<u>South Coast Subunit</u>										
Applied water	1.9	2.2	1.0	1.4	1.4	1.4	--	0.8	--	--
Precipitation	1.4	1.1	1.2	1.0	1.0	1.2	--	1.0	--	--
TOTAL	3.3	3.3	2.2	2.4	2.4	2.6	--	1.8	--	--
<u>Rincon Creek Hydrologic Unit</u>										
<u>Unit</u>										
Applied water	2.1	2.1	1.3	1.0	--	1.3	1.6	0.6	1.1	3.0
Precipitation	1.1	1.1	0.9	1.1	--	1.3	1.1	0.9	1.0	1.0
TOTAL	3.2	3.2	2.2	2.1	--	2.6	2.7	1.5	2.1	4.0
<u>Ventura River Hydrologic Unit</u>										
<u>Lower Ventura River Subunit</u>										
Applied water	2.1	2.1	1.3	1.0	1.1	1.3	1.6	0.6	1.1	3.0
Precipitation	1.1	1.1	0.9	1.1	1.0	1.3	1.1	0.9	1.0	1.0
TOTAL	3.2	3.2	2.2	2.1	2.1	2.6	2.7	1.5	2.1	4.0
<u>Upper Ventura River and Ojai Subunits</u>										
Applied water	2.5	2.5	1.6	1.2	--	1.5	1.6	0.6	1.2	3.0
Precipitation	1.1	1.1	0.9	1.0	--	1.2	1.3	0.9	1.0	1.0
TOTAL	3.6	3.6	2.5	2.2	--	2.7	2.9	1.5	2.2	4.0
<u>Santa Clara-Calleguas Hydrologic Unit</u>										
<u>Oxnard Plain Subunit</u>										
Applied water	2.1	2.1	1.3	1.0	1.1	1.3	1.6	0.6	1.1	3.0
Precipitation	1.1	1.1	0.9	1.1	1.0	1.3	1.1	0.9	1.0	1.0
TOTAL	3.2	3.2	2.2	2.1	2.1	2.6	2.7	1.5	2.1	4.0
<u>Santa Paula, Sespe, Piru and Upper Santa Clara River Subunits</u>										
Applied water	2.4	2.4	1.4	1.2	1.1	1.4	1.6	0.8	1.2	3.0
Precipitation	1.1	1.1	1.0	0.9	1.0	1.2	1.2	0.8	1.0	1.0
TOTAL	3.5	3.5	2.4	2.1	2.1	2.6	2.8	1.6	2.2	4.0
<u>Calleguas-Conejo Subunit</u>										
Applied water	2.3	2.3	1.3	1.0	1.1	1.5	1.7	0.6	1.1	3.0
Precipitation	1.1	1.1	1.0	1.1	1.1	1.2	1.1	1.0	1.1	1.0
TOTAL	3.4	3.4	2.3	2.1	2.2	2.7	2.8	1.6	2.2	4.0
<u>Malibu Hydrologic Unit</u>										
<u>Malibu Creek and Camarillo Subunits</u>										
Applied water	2.3	2.3	1.3	1.0	1.1	1.5	1.7	0.6	1.1	3.0
Precipitation	1.1	1.1	1.0	1.1	1.1	1.2	1.1	1.0	1.1	1.0
TOTAL	3.4	3.4	2.3	2.1	2.2	2.7	2.8	1.6	2.2	4.0
<u>Los Angeles-San Gabriel River Hydrologic Unit</u>										
<u>San Fernando Subunit</u>										
Applied water	2.3	2.5	1.5	1.2	1.2	1.5	1.7	0.7	--	--
Precipitation	1.4	1.2	1.1	0.9	0.9	1.3	1.2	1.0	--	--
TOTAL	3.7	3.7	2.6	2.1	2.1	2.8	2.9	1.7	--	--
<u>San Joaquin Valley Area</u>										
Applied water	3.3	3.3	2.3	0.9	1.5	2.3	--	0.6	--	--
Precipitation	0.7	0.7	0.7	0.7	0.7	0.7	--	0.7	--	--
TOTAL	4.0	4.0	3.0	1.6	2.2	3.0	--	1.3	--	--

water in areas where runoff from irrigation and deep percolation are not available for reuse. In those areas, the total use of applied water was computed by dividing the consumptive use of applied water by 0.70.

It should be pointed out that in the derivation of the net water use for any given year, the volume of applied water required is based on the assumption that the precipitation for the season was equal to the long-time mean. However, the use of applied water will actually be somewhat larger or smaller in individual years, varying inversely with the amount of rainfall. A similar effect occurs in the instance of urban use; however, the use of precipitation by residential, commercial, and industrial classifications is relatively small. Therefore, variations of rainfall from year to year have a lesser effect upon the use of applied water by these land use classes than by irrigated lands.

Net Water Use

Estimates of the amount of net water use in the investigational area under 1961 conditions of development are presented in this section. In water service areas overlying or tributary to free ground water basins, it was assumed that all applied water in excess of consumptive use requirements, except the portions of sewage and industrial waste exported from the area, returned to ground water storage and is available for reuse. The net water use for these areas was, therefore, estimated to be the sum of the consumptive use of applied water, plus sewage and industrial waste export. In water service areas overlying or tributary to confined ground water basins, as designated in Chapter II, it was assumed that applied water in excess of consumptive use would not return to ground water storage;

therefore, net water use for these areas was considered equivalent to total delivered water. This latter method was also applied to unconfined areas where ground water quality has been degraded to a point where reuse is not presently practical.

The estimated amounts of mean seasonal net water use in hydrologic units of Ventura County and Upper Santa Clara River Drainage Area for 1961 land use conditions are presented in Table 13. This table indicates that the net water use is approximately 225,400 acre-feet, of which 174,800 acre-feet, or 78 percent, is used by agriculture, while urban-suburban use amounted to 50,600 acre-feet.

TABLE 13

ESTIMATED LEVELS OF NET WATER USE IN HYDROLOGIC UNITS OF
VENTURA COUNTY AND UPPER SANTA CLARA RIVER DRAINAGE
AREA FOR CONDITIONS OF DEVELOPMENT IN 1961

In acre-feet

Hydrologic unit	Irrigated lands	Urban-suburban	Total
Santa Maria-Cuyama	300	100	400
Santa Ynez	0	0	0
Santa Barbara	200	*	200
Rincon Creek	*	700	700
Ventura River	6,600	10,300	16,900
Santa Clara-Calleguas	166,900	39,300	206,200
Malibu	600	200	800
Los Angeles-San Gabriel River	*	*	*
San Joaquin Valley	200	*	200
Total Investigational Area	174,800	50,600	225,400

* Less than 50 acre-feet.

The data presented in Table 14 indicate the changes in net water use between 1950 and 1961 on the basis of hydrographic units. The 1950 water use was obtained from Bulletin No. 2 basic data, while the 1961

comparable use was determined by grouping the water uses of the various hydrologic units in Table 13 into appropriate hydrographic units. Several of the hydrologic units lie outside the hydrographic unit areas, but the net water use within these excluded areas is negligible, as can be seen by comparing the 1961 totals of Tables 13 and 14.

TABLE 14

ESTIMATED LEVELS OF NET WATER USE IN VENTURA COUNTY AND
UPPER SANTA CLARA RIVER DRAINAGE AREA BY
HYDROGRAPHIC UNITS FOR CONDITIONS OF DEVELOPMENT IN 1950 AND 1961

In acre-feet

Hydrographic unit	:	1950	:	1961	:	Difference
Hydrographic Unit 1 (Ventura and Rincon Creek)						
Irrigated lands		7,500		6,600	-	900
Urban-suburban areas		5,800		11,000		5,200
Subtotal		13,300		17,600		4,300
Hydrographic Unit 2 (Santa Clara - Calleguas)						
Irrigated lands		166,900		166,900		0
Urban-suburban areas		16,700		39,300		22,600
Subtotal		183,600		206,200		22,600
Total Hydrographic Units						
Irrigated lands		174,400		173,500	-	900
Urban-suburban areas		22,500		50,300		27,800
TOTAL		196,900		223,800		26,900

From Table 14, it can be seen that between 1950 and 1961 the net water use increased 26,900 acre-feet, or almost 14 percent. The present level of net water use by irrigated agriculture remains relatively the same as that of 1950, but urban-suburban use increased about 124 percent. The Santa Clara-Calleguas Hydrographic Unit accounted for the greatest gain in urban-suburban water use, increasing 22,600 acre-feet since 1950,

or 135 percent. Although the Ventura Hydrographic Unit is smaller in area, urban-suburban water use increased 5,200 acre-feet, or 90 percent. Agriculture in this unit experienced a decline of about 900 acre-feet, a 12 percent loss.

The unit values used to derive the net water use represent the optimum needs of the various types of water using developments for mean conditions of temperature and precipitation and, therefore, provide comparable estimates which show general level of water use. The actual water use may have differed from the estimated values derived herein because of irrigation practices and variations from the mean in precipitation, or because optimum needs were not being met. Averages of data from representative precipitation stations located in the investigational area indicate that rainfall during 1950 was from 45 to 56 percent of normal for the 50-year period, 1897-98 through 1946-47, and during 1961 from 41 to 50 percent of this normal. Therefore, the estimates of the level of net water use shown in Tables 13 and 14 for 1950 and 1961 are probably on the low side as compared to actual water use. However, the difference between estimates for the two years shown is considered to represent a reasonable estimate of the increase in water use.

Comparison of Water Supply and Water Use

The amounts of net water use for 1932, 1950, and 1961, determined from land use surveys, are shown on Table 15, together with the estimated mean annual safe yield of local water supplies previously reported in Chapter II. The forecast net water use for the year 1990, as derived from studies by the Department of Water Resources for water contracting purposes, is also presented in Table 15.

TABLE 15

COMPARISON OF NET WATER USE AND WATER SUPPLY OF VENTURA
COUNTY AND UPPER SANTA CLARA RIVER DRAINAGE AREA

In acre-feet

Date of survey	Net water use	Approximate mean annual safe yield of local water supplies	Excess of net water use over mean annual safe yield of local water supplies
1932	170,700	140,700	30,000
1950	197,700	142,100	55,600
1961	225,400	186,300	39,100
1990	356,400*	213,800**	142,600

* Estimated.

**Includes development of Sespe Creek.

The values presented in Table 15 indicate that overdraft conditions have existed within the investigational area since 1932. Water salvage programs were not initiated until the late 1940's, but since then, progress has been made in planning and constructing various reservoirs. Matilija Reservoir was completed in 1948, and Santa Felicia Dam and Casitas Reservoir were constructed in the 1950's. New water developed by these latter projects probably accounts for the decrease in overdraft between 1950 and 1961 indicated in Table 15.

With the planned development of Sespe Creek, the safe yield of local water supplies in the investigational area is estimated to be 213,800 acre-feet annually by the year 1990. To supplement local water supplies, Colorado River water, since 1963, has been imported to the study area, and water from the State Water Facilities is expected to be available for importation in the early 1970's.

Studies developed by the department for water contracting purposes indicate that the estimated total seasonal net water use for the investigational area will be about 356,400 acre-feet by the year 1990. The remaining 142,600 acre-feet to meet the additional requirement for water will have to be met by additional importation of Colorado River water and water from the State Water Facilities, together with reclamation of waste waters and desalinization of salt water as economic and technological considerations permit.

CHAPTER V. SUMMARY AND CONCLUSIONS

The results of the 1961 land and water use survey of Ventura County and Upper Santa Clara River Drainage Area, comparisons with the 1950 survey results, and conclusions drawn from this study are summarized in this chapter.

Summary

The land and water use survey indicated that during 1961 the following acreages in the investigational area were included in water service areas:

Gross urban and suburban area . . . 52,750 acres

Gross irrigated agriculture area . . 123,490 acres

Gross water service area 176,240 acres

The net annual water use in this water service area was 225,400 acre-feet.

In the hydrographic units which were surveyed in 1950 and utilized as a basis for comparison during the 1961 survey, the following changes occurred between 1950 and 1961:

1. The population of the surveyed area increased from 124,916 to 230,121; this is an increase of 105,205 or about 84 percent.

2. The gross water service area increased from 152,400 acres in 1950 to 174,600 acres in 1961, an increase of about 22,200 acres or nearly 15 percent.

3. The gross urban and suburban acreage expanded from 29,300 acres in 1950 to 52,000 acres in 1961, an increase of 22,700 acres, or more than 77 percent.

4. The gross irrigated agriculture acreage decreased slightly from 123,100 acres in 1950 to 122,600 acres in 1961, a reduction of 500 acres.

5. Net water use increased from 196,900 acre-feet in 1950 to 223,800 acre-feet in 1961, a rise of 26,900 acre-feet, or almost 14 percent.

6. The excess of net water use over mean annual safe yield of local water supplies in the investigational area decreased from 55,600 acre-feet in 1950 to 39,100 acre-feet in 1961. Despite this decrease, however, it is anticipated that by 1990 net water use in the area will exceed the mean annual safe yield of local supplies by 142,600 acre-feet.

Conclusions

Based on the results of this investigation, it is concluded that:

1. The population within the investigational area will increase as new development occurs in the area. The rate of increase will probably continue to rise for the next few years as maximum development is approached in neighboring coastal Los Angeles County. It is estimated that the population of Ventura County alone will increase from about 199,000 in 1960 to about 1,100,000 by 1990.

2. Urban and suburban growth is increasing rapidly throughout the coastal portion and inland valleys of Ventura County.

3. Agricultural development is at or past its peak in the investigational area; this type of development is expected to decline with the increasing encroachment of urban and suburban development.

4. Present water supply development plans for both local and imported supplies will insure that the needs of the continued urban and suburban growth can be met, but net water use in the survey area will probably continue to exceed safe yield of local water supplies for many years. For this reason, increasing amounts of imported water will be needed as the area continues to develop. A continuing program of land and water use surveys in this area will provide information that can be used by those who must plan for, and develop, the necessary supplies.

APPENDIX A

DEFINITION OF TERMS



APPENDIX A

DEFINITION OF TERMS

Annual - The 12-month period from January 1 of a given year through December 31 of the same year, sometimes termed the "calendar year".

Applied Water - Water delivered to a farmer's headgate, in the case of irrigation use, or to an individual's meter in the case of urban use, or its equivalent. Applied water does not include direct precipitation.

Aquifer - A geologic formation or structure sufficiently permeable to yield water to wells or springs.

Average - An arithmetical average relating to a period other than a mean period.

Confined Ground Water - A body of ground water immediately overlain by material sufficiently impervious to sever free hydraulic connection with overlying water, and acted upon by pressure caused by the difference in head between the intake or forebay area and the discharge area of the confined water body.

Consumptive Use of Water - Water consumed by vegetative growth in transpiration and building plant tissue, and water evaporated from adjacent soil, from water surface, and from foliage. It also refers to water similarly consumed and evaporated by urban and nonvegetative types of land use.

Free Ground Water - A body of ground water not immediately overlain by impervious materials.

Ground Water Overdraft - The annual net extraction of water from a ground water basin in excess of safe ground water yield.

Hydrographic Unit - A classification, established for purposes of hydrologic study, used in Bulletin No. 2 to designate an area whose boundaries were determined from consideration of water supply and related water service.

Hydrologic Unit* - In this bulletin, a classification embracing one of the following two topographic characteristics, both of which are defined by surface drainage divides:

- a. In general, the total watershed area, including water-bearing and nonwater-bearing formations, such as the total drainage area of the Ventura River Valley.
- b. In coastal areas, two or more small contiguous watersheds having similar hydrologic characteristics and water supply problems, each watershed being directly tributary to the ocean and all watersheds emanating from one mountain body located immediately adjacent to the ocean.

Hydrologic Subunit* - In this bulletin, a major logical subdivision of a hydrologic unit, including water-bearing and nonwater-bearing formations, best typified by a major tributary of a stream, a major valley, or a plain along a stream containing one or more ground water basins and having closely related geologic, hydrologic, and topographic characteristics.

* The areal designation system, i.e. categorizing areas into units, sub-units, and subareas, is designed to separate data according to areas of hydrologic significance. The system, as developed, does not differentiate between ground water-bearing formations and nonground water-bearing tributary areas, although land use, as inventoried, does differentiate between such boundaries.

Hydrologic Subarea* - In this bulletin, a logical subdivision of a hydrologic subunit which may include either water-bearing or nonwater-bearing formations or both. Where possible, a hydrologic subarea includes one known ground water basin and its tributary area; the ground water basin comprising the water-bearing deposits of the sub-area. In areas which are essentially nonwater-bearing, the subarea division was based only on surface drainage conditions, and such factors as locations of gaging stations were given due consideration.

Irrigation Efficiency - The ratio of consumptive use of applied irrigation water to the total amount of water applied, expressed as a percentage.

Mean - An arithmetical average relating to a mean period.

Mean Period - A period chosen to represent conditions of water supply and climate over a long series of years. For purposes of the current investigation, the mean precipitation period embraces the 50 seasons from 1897-98 through 1946-47.

Net Water Use - That portion of the water historically applied, or estimated to have been applied, which is consumptively utilized for beneficial purposes or otherwise irrecoverably lost. It does not include that portion of the applied water which is subject to possible reuse.

Present - Land use and water use and supply conditions prevailing during the 1960-61 season.

* The areal designation system, i.e. categorizing areas into units, sub-units, and subareas, is designed to separate data according to areas of hydrologic significance. The system, as developed, does not differentiate between ground water-bearing formations and nonground water-bearing tributary areas, although land use, as inventoried, does differentiate between such boundaries.

Safe Ground Water Yield - The average annual net amount of water that could be beneficially extracted from a ground water basin over an indefinitely long period of years, under a particular set of those physical conditions affecting supply to and disposal from, the ground water basin, without causing a net lowering of ground water levels during the period.

Seasonal - Any 12-month period other than the calendar year.

Water Use - Water use includes all employments of water by nature or man, whether consumptive or nonconsumptive, as well as irrecoverable losses of water incidental to such employment, and is synonymous with the term "water utilization".

APPENDIX B

LAND USE IN HYDROLOGIC UNITS, SUBUNITS,
AND SUBAREAS OF VENTURA COUNTY AND
UPPER SANTA CLARA RIVER DRAINAGE
AREA, 1961



APPENDIX B

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS OF VENTURA COUNTY
AND UPPER SANTA CLARA RIVER DRAINAGE AREA, 1961

In acres

		Santa Maria	Santa Ynez	Santa Barbara	Rincon Creek	Venture River	Venture River	Venture River Hydrologic Unit
Category and class of land use		Hydrologic Unit	Hydrologic Unit	Hydrologic Unit	Hydrologic Unit	Subunit	Subunit	Subunit
<u>WATER SERVICE AREA</u>								
Urban and Suburban								
Residential	20	0	0	60	890	1,240	36d	810
Commercial	10	0	0	0	360	80	110	2,970
Industrial	0	0	0	50	340	20	20	550
Unsegregated urban and suburban areas	<u>70</u>	<u>0</u>	<u>0</u>	<u>30</u>	<u>110</u>	<u>270</u>	<u>50</u>	<u>380</u>
Subtotals	100	0	10	140	1,700	1,610	80	<u>710</u>
Included Nonwater Service Area	<u>30</u>	<u>0</u>	<u>d</u>	<u>—</u>	<u>1,320</u>	<u>3,280</u>	<u>730</u>	<u>750</u>
Gross Urban and Suburban Area	130	0	10	1,460	4,980	2,340	140	1,970
Irrigated Agriculture								
Alfalfa	60	0	0	0	0	30	10	0
Pasture	20	0	0	0	0	190	0	70
Citrus and subtropical	0	0	180	0	490d	610	0	260
Truck crops	0	0	0	40	0	30	0	1,510
Field crops	0	0	0	0	0	0	10	440
Deciduous fruits and nuts	d	0	0	0	350	160	90	0
Small grains	0	0	0	0	10	40	0	690
Subtotals	80	0	180	40	850	1,060	100	<u>50</u>
Fallow	10d	0	0	90d	10	0	0	0
Included Nonwater Service Area	<u>—</u>	<u>0</u>	<u>10</u>	<u>—</u>	<u>60</u>	<u>90</u>	<u>10</u>	<u>20</u>
Gross Irrigated Agriculture	<u>90</u>	<u>0</u>	<u>190</u>	<u>—</u>	<u>130</u>	<u>920</u>	<u>1,150</u>	<u>1,770</u>
GROSS WATER SERVICE AREA	220	0	200	1,590	5,900	3,490	250	<u>3,250</u>
<u>NONWATER SERVICE AREA</u>								
Nonirrigated Agriculture	1,000	0	0	0	180	930	1,180	380
Native vegetation	50,400	0	0	420	2,360	3,740	440	2,370
Unclassified	<u>108,260</u>	<u>1,670</u>	<u>6,210</u>	<u>12,000</u>	<u>21,860</u>	<u>85,460</u>	<u>3,330</u>	<u>14,870</u>
GROSS NONWATER SERVICE AREA	<u>159,660</u>	<u>1,670</u>	<u>6,210</u>	<u>12,420</u>	<u>24,400</u>	<u>90,130</u>	<u>4,250</u>	<u>17,620</u>
TOTALS	159,880	1,670	7,110	14,010	30,300	93,620	5,200	21,360
								150,480

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS OF VENTURA COUNTY
AND UPPER SANTA CLARA RIVER DRAINAGE AREA, 1961
(continued)

In acres

Santa Clara-Collegues Hydrologic Unit									
Piru Subunit		Upper Santa Clara River Subunit		Sierra Pelona Subarea		Action Subarea		Callegus-Conejo Subunit	
Category and class of land use	Subarea	Eastern Subarea	Bouquet Subarea	Mint Subarea	Clare Subarea	West Subarea	East Subarea	Las Posas Subarea	Las Posas Subarea
WATER SERVICE AREA									
Urban and Suburban									
Residential									
Hungry Valley Subarea	30	1,290	0	40	80	50	60	290	290
Subarea	0	390	0	10	10	30	10	40	40
Commercial	10	450	0	0	0	20	10	50	50
Industrial	50	1,530	20	10	80	220	180	480	480
Unsegregated urban and suburban area	20								
Subtotals	30	3,660	20	60	170	320	250	860	860
Included Nonwater Service Area	100	4,140	0	20	70	120	210	290	290
Gross Urban and Suburban Area	130	280	7,800	20	80	240	440	460	1,850
IRRIGATED AGRICULTURE									
Alfalfa	110	2,790	0	0	0	30	0	0	210
Pasture	30	620	0	0	0	90	160	40	40
Citrus and subtropical	0	10	0	0	0	0	2,900	3,580	3,580
Truck crops	0	1,600	0	0	0	40	2,880	2,000	2,000
Field crops	0	340	0	0	0	10	180	40	40
Deciduous fruits and nuts	0	750	0	0	0	40	590	1,180	1,180
Small grains	0	0	0	0	0	10	0	50	50
Subtotals	30	110	6,310	0	0	20	220	6,710	7,100
Fallow	0	390	0	0	0	0	0	230	190
Included Nonwater Service Area	d	10	380	70	50	20	0	390	510
Gross Irrigated Agriculture	30	120	7,080	70	50	40	220	7,330	7,800
GROSS WATER SERVICE AREA	160	400	14,880	90	130	280	660	7,790	9,650
NONWATER SERVICE AREA									
Nonirrigated Agriculture	3,240	5,180	10	10	0	300	780	2,490	2,490
Native Vegetation	21,320	48,770	340	2,720	4,400	18,270	3,100	25,960	25,960
Unclassified	16,010	29,370	229,440	8,240	8,020	6,190	70,730	2,360	13,890
GROSS NONWATER SERVICE AREA	40,570	37,300	283,360	8,590	10,750	10,590	89,300	6,240	42,340
TOTALS	40,730	37,700	298,240	8,680	10,880	10,870	89,960	14,030	51,990

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS OF VENTURA COUNTY
AND UPPER SANTA CLARA RIVER DRAINAGE AREA, 1961

(continued)

In acres

Category and class of land use	Santa Clara-Collegues Hydrologic Unit						Total	
	Caliague-Conejo Subunit			Simi Valley Subunit				
	Arroyo	Conejo Valley	Tierra Rejada	Gillibrand	Simi Valley	Thousand Oaks		
Santa Rosa	Subarea	Subarea	Subarea	Subarea	Subarea	Subarea		
WATER SERVICE AREA								
Urban and Suburban								
Residential	10	900	0	0	1,210	640	10,850	
Commercial	d	100	0	0	100	70	2,300	
Industrial	d	40	0	40	0	0	1,880	
Unseggregated urban and suburban area	30	130	30	20	380	120	5,230	
Subtotals	40	1,170	30	20	1,730	830	20,260	
Included Nonwater Service Area	20	1,450	d	10	1,160	910	20,250	
GROSS URBAN AND SUBURBAN AREA	60	2,620	30	30	2,890	1,740	41,210	
Irrigated Agriculture								
Alfalfa	d	40	50	0	120	0	4,110	
Pasture	10	30	90	0	120	50	2,700	
Citrus and subtropical	1,640	80	190	0	1,880	10	48,460	
Truck crops	560	10	0	0	440	0	42,210	
Field crops	d	30	0	0	110	0	1,470	
Deciduous fruits and nuts	320	290	80	0	1,360	30	7,220	
Small grains	0	0	0	0	160	0	220	
Subtotals	2,530	480	410	0	4,190	90	106,120	
Fallow	150	30	160	0	50	0	5,050	
Included Nonwater Service Area	240	220	20	0	140	30	7,230	
Gross Irrigated Agriculture	2,920	730	590	0	4,680	120	118,700	
GROSS WATER SERVICE AREA	2,980	3,350	620	30	7,570	1,860	159,910	
NONWATER SERVICE AREA								
Nonirrigated Agriculture	410	590	370	420	2,010	180	19,750	
Native vegetation	670	510	20	4,350	3,290	520	176,440	
Unclassified	3,420	13,250	3,550	6,050	28,790	8,820	930,370	
GROSS NONWATER SERVICE AREA	4,500	14,350	3,240	10,820	34,090	9,520	14,126,560	
TOTALS	7,480	17,700	4,560	10,850	41,660	11,380	1,286,470	

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS OF VENTURA COUNTY
AND UPPER SANTA CLARA RIVER DRAINAGE AREA, 1961
(continued)

In acres

Category and class of land use	Santa Clara-Callegas Hydrologic Unit			Piru Subunit		
	Oxnard Plain Subunit	Santa Paula Subunit	Sisar Subarea	Pillmore Subarea	Sespe Subarea	Piru Subarea
<u>WATER SERVICE AREA</u>						
Urban and Suburban						
Residential	4,320	580	940	30	270	10
Commercial	1,110	190	160	0	70	30
Industrial	800	110	190	110	0	0
Unseggregated urban and suburban area	<u>840</u>	<u>410</u>	<u>340</u>	<u>30</u>	<u>190</u>	<u>10</u>
Subtotals	7,070	1,290	1,630	70	640	40
Included Nonwater Service Area	<u>6,400</u>	<u>1,470</u>	<u>1,430</u>	<u>20</u>	<u>1,430</u>	<u>20</u>
Gross Urban and Suburban Area	13,470	2,760	3,060	160	2,070	130
<u>Irrigated Agriculture</u>						
Alfalfa	420	80	0	20	0	120
Pasture	370	210	0	380	0	210
Citrus and subtropical	11,330	3,940	8,390	20	9,910	0
Truck crops	21,540	10,260	2,250	0	580	^a 4,580
Field crops	270	280	90	0	120	0
Deciduous fruits and nuts	520	1,590	370	0	30	50
Small grains	20	10	0	0	0	0
Subtotals	34,170	16,570	11,390	20	11,040	10
Fallow	2,960	620	130	0	70	0
Included Nonwater Service Area	<u>1,250</u>	<u>1,130</u>	<u>660</u>	<u>0</u>	<u>820</u>	<u>0</u>
Gross Irrigated Agriculture	<u>39,080</u>	<u>18,320</u>	<u>12,180</u>	<u>20</u>	<u>11,930</u>	<u>10</u>
GROSS WATER SERVICE AREA	52,550	21,080	15,240	180	14,000	140
<u>NONWATER SERVICE AREA</u>						
Nonirrigated Agriculture	440	1,800	650	80	210	0
Native Vegetation	7,380	2,800	6,840	650	6,980	0
Unclassified	<u>11,820</u>	<u>8,690</u>	<u>45,320</u>	<u>6,090</u>	<u>25,290</u>	<u>160,380</u>
GROSS NONWATER SERVICE AREA	<u>19,640</u>	<u>13,290</u>	<u>52,810</u>	<u>6,820</u>	<u>33,180</u>	<u>160,380</u>
TOTALS	72,190	34,370	68,050	7,000	47,180	160,520
						70,690
						169,760

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBSUBUNITS OF VENTURA COUNTY
AND UPPER SANTA CLARA RIVER DRAINAGE AREA, 1961

(continued)

In acres

Category and class of land use	In acres			Malibu Hydrologic Unit	Camarillo Subunit	Camarillo Subunit
	Los Villegas	Linero	Mt. Lino Creek Subunit			
	Canyon	Canyon	Valley	Subarea	Subarea	Subarea
	Subarea	Subarea	Subarea			
<u>WILDE LIFE AREA</u>						
Urban and suburban residential	0	0	0	50	0	30
Campground	0	0	0	0	10	20
Industrials	0 ^d	0 ^d	0	0	0	0
Included urban and suburban areas	-	-	30	0	0	0
Subtotal	0	0	30	90	10	60
Included Nonwater Service Area	d	d	-	30	d	d
GROSS URBAN AND SUBURBAN AREA	0	0	30	120	10	130
<u>Irrigated Agriculture</u>						
Alfalfa	0	0	0	20	0	0
Flax	0	0	0	210	0	10
Citrus and subtropical	0	0	0	10	0	0
Truck crops	0	0	0	0	0	10
Field crops	0	0	70	0	0	0
Dedicated fruits and nuts	0	0	0	0	0	0
Small grains	0	0	0	0	0	0
Subtotal	0	0	70	240	0	10
Fallow	0	0	10 ^d	0	0	10 ^d
Included Nonwater Service Area	0	0	-	10	0	-
Gross Irrigated Agriculture	0	0	80	250	0	10
Gross Water Service Area	0	0	110	370	10	140
<u>NONWATER SERVICE AREA</u>						
<u>Nonirrigated Agriculture</u>	0	280	700	1,010	0	0
Native Vegetation	80	90	380	560	0	0
Unclassified	<u>2,010</u>	<u>7,860</u>	<u>3,090</u>	<u>7,690</u>	<u>2,850</u>	<u>3,660</u>
Gross Nonwater Service Area	<u>2,090</u>	<u>8,230</u>	<u>4,170</u>	<u>9,260</u>	<u>2,850</u>	<u>3,660</u>
TOTALS	<u>9,090</u>	<u>8,230</u>	<u>4,180</u>	<u>9,630</u>	<u>2,860</u>	<u>3,800</u>

LAND USE IN HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS OF VENTURA COUNTY
AND UPPER SANTA CLARA RIVER DRAINAGE AREA, 1961

(continued)

In Acres

Category and class of land use	Malibu Hydrologic Unit			Los Angeles:		
	Camarillo Subunit	La Jolla	Total	San Gabriel	San Joaquin	Investigational Total
Big Sycamore: Canyon : Subarea :	0	0	0	0	0	0
Subarea :	0	0	0	10	10	10
Subtotals	10	0	90	20	10	14,020
Included Nonwater Service Area	10	10	20	10	10	2,900
GROSS URBAN AND SUBURBAN AREA	30	10	330	120	60	2,320
<u>Irrigated Agriculture</u>						
Alfalfa	0	0	20	0	50	4,280
Pasture	0	0	220	0	20	3,220
Citrus and subtropical	0	0	10	0	0	51,260
Truck crops	0	0	10	0	0	42,300
Field crops	0	0	70	0	0	1,540
Deciduous fruits and nuts	0	0	0	0	0	7,910
Small grains	0	0	0	0	0	300
Subtotals	0	0	330	0	70	110,810
Fallow:	0	0	20	0	0	5,180
Included Nonwater Service Area	0	0	10	0	0	7,500
Gross Irrigated Agriculture	0	0	360	0	70	123,490
GROSS WATER SERVICE AREA	30	10	690	120	130	176,240
<u>NONWATER SERVICE AREA</u>						
Nonirrigated Agriculture	150	0	2,140	0	510	26,070
Native vegetation	240	0	1,350	0	2,340	239,860
Unclassified	13,160	2,870	48,360	6,060	14,810	1,253,960
GROSS NONWATER SERVICE AREA	13,550	2,870	51,850	6,060	17,660	1,519,890
TOTALS	13,580	2,880	52,540	6,180	17,790	1,696,130

APPENDIX C

LIST OF DISTRICTS, AREAS, AND UNITS
FOR WHICH INDIVIDUAL TABULATIONS
OF 1961 LAND USES ARE AVAILABLE



APPENDIX C

LIST OF DISTRICTS, AREAS, AND UNITS FOR WHICH INDIVIDUAL TABULATIONS OF 1961 LAND USES ARE AVAILABLE

Utilizing machine techniques that were developed for processing data from this survey, individual tabulations of 1961 land uses can be obtained for most of the political and hydrologic subdivisions within the area of investigation. However, reasonable limitations do not permit all of these individual tabulations to be published in this report.

For those requiring more detailed information, this appendix lists all political subdivisions for which 1961 land use within the investigational area can be individually determined and tabulated by machine methods using data available in State Department of Water Resources files. It should be noted that data were based on 1961 conditions, including boundaries, and have not been modified to reflect subsequent changes, if any.

County Water Districts

Newhall	Oxnard Beach
Meiners Oaks	Pleasant Valley
Ocean View	Ventura River

Ventura County Waterworks Districts

Nos. 1, 3, 4, 5, 6, 7, 8

Municipal Water Districts

Calleguas	Ocean View
Colonia	Russell Valley

Municipal Water Districts (continued)

Del Norte
Hidden Valley

Ventura River

Drainage Districts

Oxnard District Nos. 1, 2, 3

Sanitary Districts

Camarillo
Meiners Oaks
Oak View

Port Hueneme
Saticoy

Ventura County Flood Control District

Zone Nos. 1, 2, 3, 4

Water Conservation Districts

San Antonio	United (continued)
Simi Valley	East Oxnard Unit
United	Mound Unit
Santa Clara River Valley Unit	Ocean View Unit
Colonia Unit	Oxnard Unit
Del Norte Unit	Pleasant Valley Unit
	United States Naval Missile Center Unit

Incorporated Cities

Fillmore	Port Hueneme
Ojai	Ventura (San Buenaventura)
Oxnard	Santa Paula

Miscellaneous Areas

Antelope Valley-East Kern Water Agency

Montalvo Municipal Improvement District

United States Geological Survey Quadrangle Areas

United States Bureau of Census Divisions

United States Naval Air Missile Test Center, Point Mugu

United States Naval Construction Battalion Center, Port Hueneme

Angeles National Forest

Los Padres National Forest



APPENDIX D

LIST OF REFERENCES



APPENDIX D

LIST OF REFERENCES

In addition to references described in the body of the report, the following reports also contain information utilized in the present investigation:

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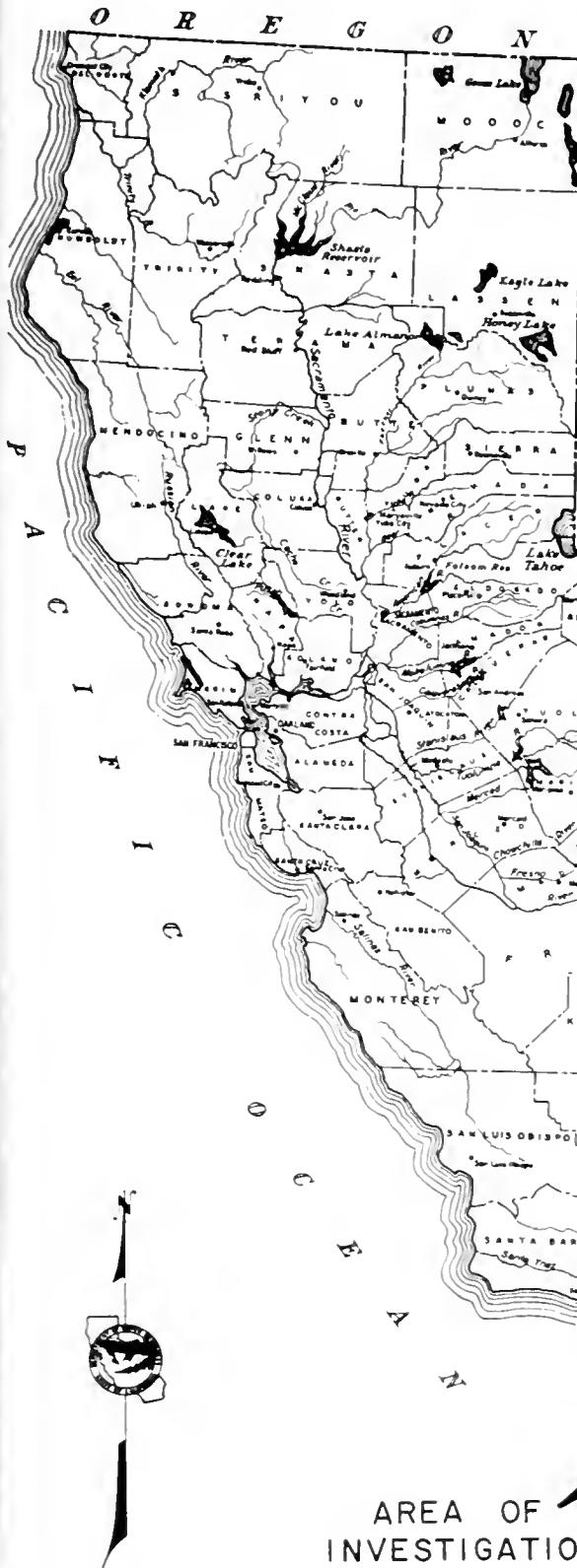
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STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

VENTURA COUNTY AND UPPER SANTA CLARA RIVER
DRAINAGE AREA
LAND AND WATER USE SURVEY, 1961

AREA OF INVESTIGATION

A scale bar labeled "SCALE OF MILES" with markings at 40, 0, 40, and 80. Below it is a date stamp reading "1964".

AREA OF INVESTIGATION



DESIGNATIONS OF

PORTION OF

T-12.00 San
T-12.CO

T-14.00 San
T-14.EO

T-15.00 San
T-15.CO
T-15.C4

PORTION OF

U-01.00 Rin

U-02.00 Ven
U-02.AO
U-02.B0
U-02.CO
U-02.C1
U-02.C2

U-03.00 San

U-03.AO
U-03.A1
U-03.A2
U-03.B0
U-03.B1
U-03.B2
U-03.CO
U-03.C1
U-03.C2
U-03.D0
U-03.D1
U-03.D2
U-03.D3
U-03.D4
U-03.E0
U-03.E1
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U-03.E4
U-03.E5
U-03.F0
U-03.F1
U-03.F2
U-03.F3
U-03.F4
U-03.F5
U-03.F6
U-03.F7
U-03.F8

U-04.00 Mali

U-04.B0
U-04.B2
U-04.B3
U-04.B5
U-04.B6
U-04.D0
U-04.D4
U-04.D5
U-04.D6
U-04.D7
U-04.D8

U-05.00 Los
U-05.B0
U-05.B1

V-00.00 San

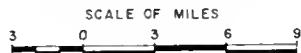
LEGEND

- Boundary of Investigational Area
- Boundary of Drainage Province
- Hydrologic Unit
- - - Hydrologic Subunit or Subarea
- - - National Forest Boundary
- U-03.B3 Hydrologic Unit, Subunit and Subarea Designations
-  Water Bearing Sediments

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

VENTURA COUNTY AND UPPER SANTA CLARA RIVER
DRAINAGE AREA
LAND AND WATER USE SURVEY, 1961

GROUND WATER BASINS
HYDROLOGIC UNITS, SUBUNITS
AND SUBAREAS



1964



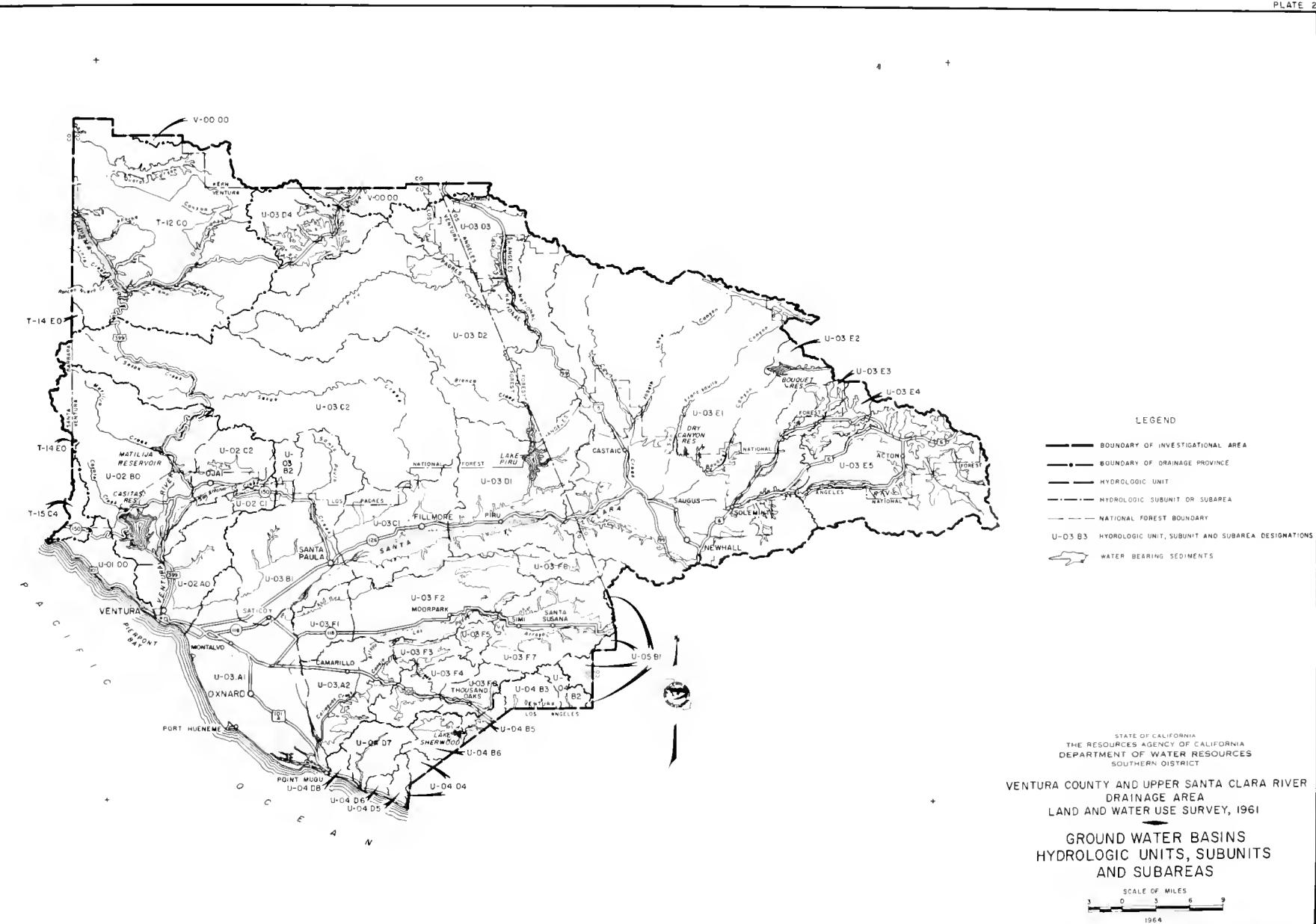
DESIGNATIONS OF HYDROLOGIC UNITS, SUBUNITS, AND SUBAREAS

PORTION OF CENTRAL COASTAL HYDROLOGIC PROVINCE

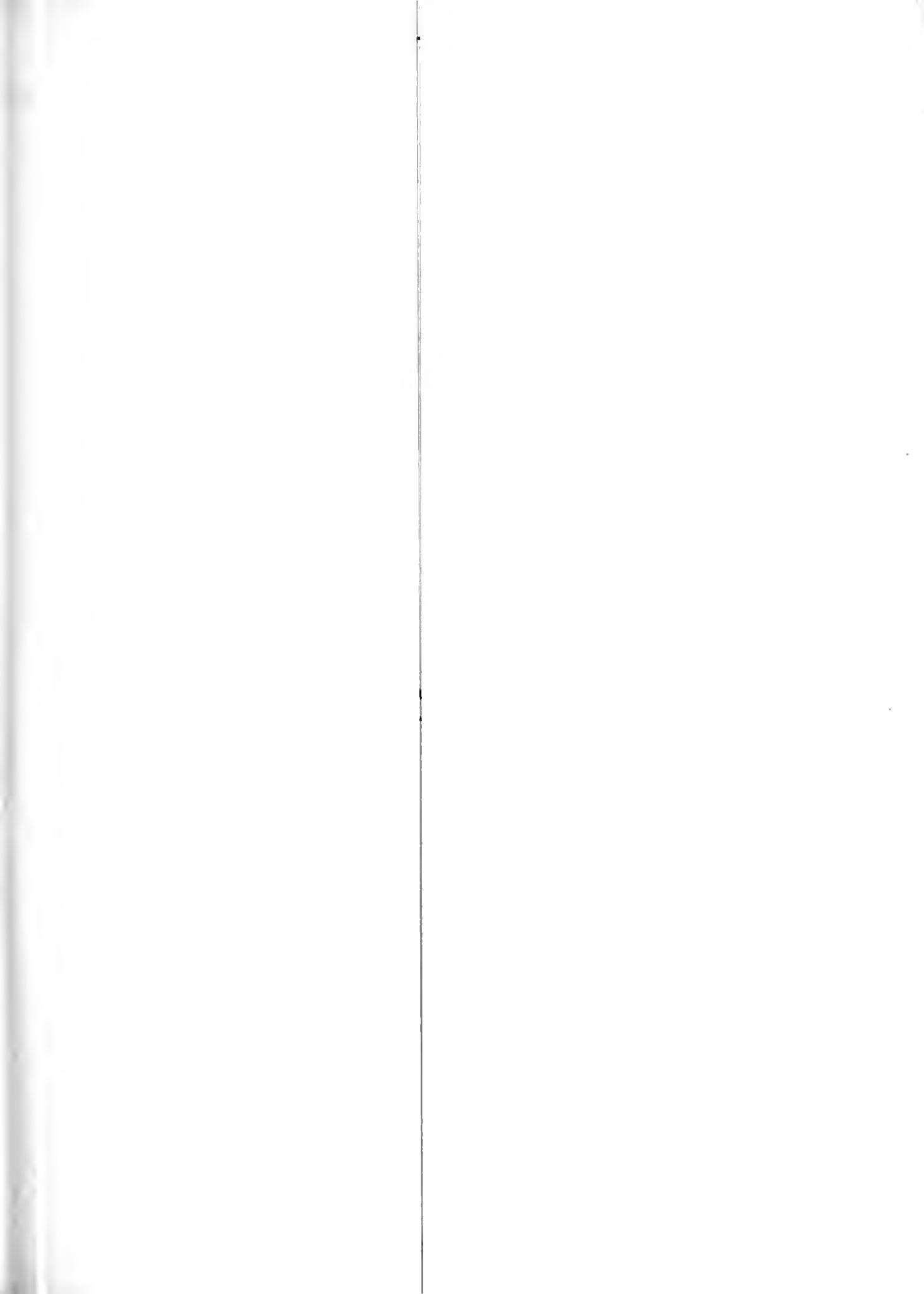
T-12.00	Santa Maria-Cuyama Hydrologic Unit
T-12.CO	Cuyama Valley Hydrologic Subunit
T-14.00	Santa Ynez Hydrologic Unit
T-14.EO	Headwater Hydrologic Subunit
T-15.00	Santa Barbara Hydrologic Unit
T-15.CO	South Coast Hydrologic Subunit
T-15.C4	Carpinteria Hydrologic Subarea

PORTION OF LOS ANGELES HYDROLOGIC PROVINCE

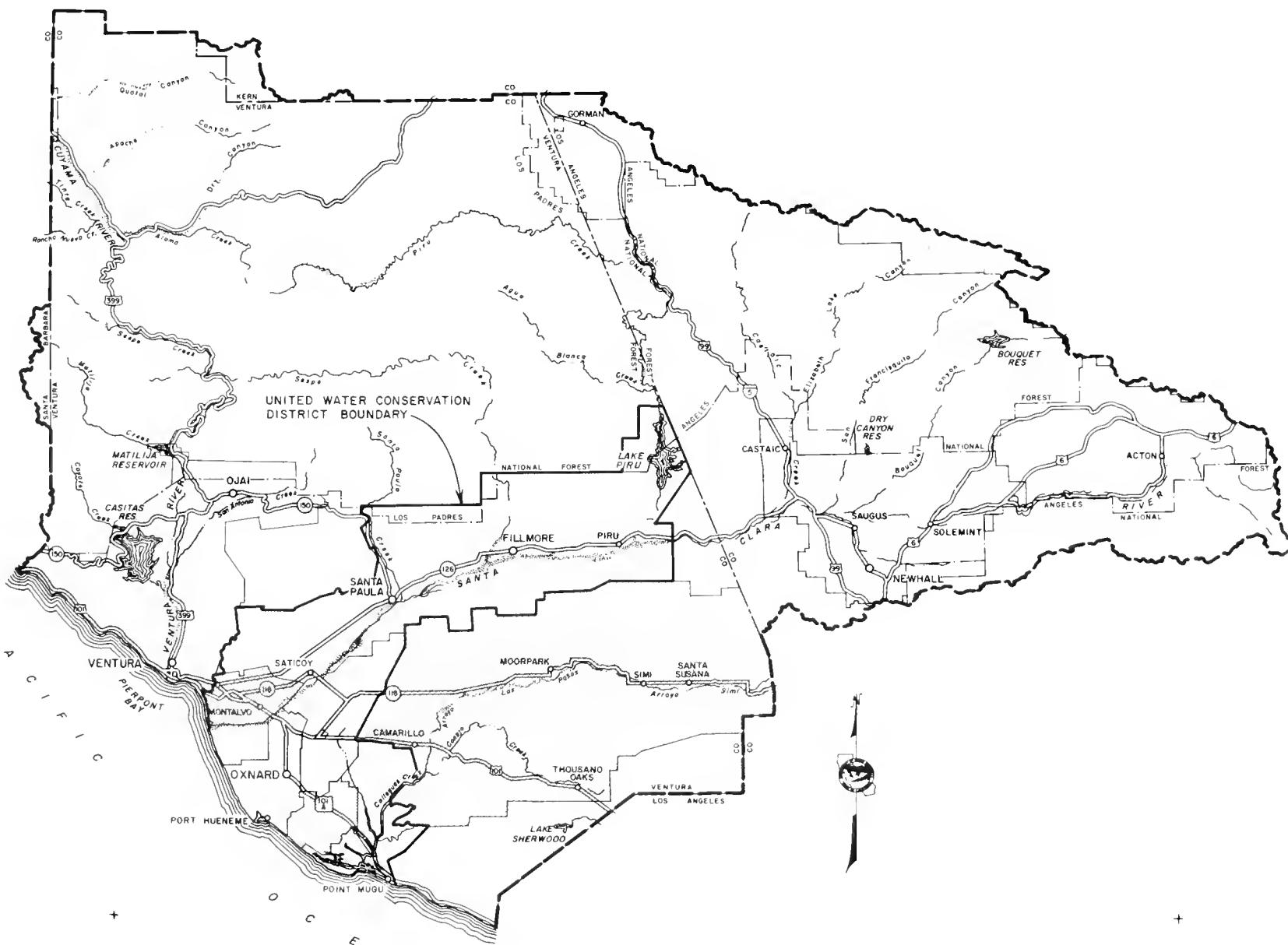
U-01.00	Hinon Creek Hydrologic Unit
U-02.00	Venture River Hydrologic Unit
U-02.A0	Lower Venture River Hydrologic Subunit
U-02.B0	Upper Venture River Hydrologic Subunit
U-02.C0	Ojai Hydrologic Subunit
U-02.C1	Upper Ojai Hydrologic Subarea
U-02.C2	Ojai Hydrologic Subarea
U-03.00	Santa Clara-Calleguas Hydrologic Unit
U-03.A0	Oxnard Plain Hydrologic Subunit
U-03.A1	Oxnard Hydrologic Subarea
U-03.A2	Pleasant Valley Hydrologic Subarea
U-03.B0	Santa Paula Hydrologic Subunit
U-03.B1	Santa Paula Hydrologic Subarea
U-03.B2	Sisar Hydrologic Subarea
U-03.C0	Sespe Hydrologic Subunit
U-03.C1	Fillmore Hydrologic Subarea
U-03.C2	Sespe Hydrologic Subarea
U-03.D0	Piru Hydrologic Subunit
U-03.D1	Piru Hydrologic Subarea
U-03.D2	Upper Piru Hydrologic Subarea
U-03.D3	Hungry Valley Hydrologic Subarea
U-03.D4	Stauffer Hydrologic Subarea
U-03.E0	Upper Santa Clara River Hydrologic Subunit
U-03.E1	Eastern Hydrologic Subarea
U-03.E2	Bouquet Hydrologic Subarea
U-03.E3	Mint Canyon Hydrologic Subarea
U-03.E4	Sierra Pelona Hydrologic Subarea
U-03.E5	Acton Hydrologic Subarea
U-03.F0	Calleguas-Conejo Hydrologic Subunit
U-03.F1	West Los Posas Hydrologic Subarea
U-03.F2	East Los Posas Hydrologic Subarea
U-03.F3	Arroyo Santa Fe Hydrologic Subarea
U-03.F4	Conejo Valley Hydrologic Subarea
U-03.F5	Tierra Rejada Valley Hydrologic Subarea
U-03.F6	Gillibrand Hydrologic Subarea
U-03.F7	Simi Valley Hydrologic Subarea
U-03.F8	Thousand Oaks Hydrologic Subarea
U-04.00	Malibu Hydrologic Unit
U-04.B0	Malibu Creek Hydrologic Subunit
U-04.B2	Las Virgenes Canyon Hydrologic Subarea
U-04.B3	Lindero Canyon Hydrologic Subarea
U-04.B5	Russell Valley Hydrologic Subarea
U-04.B6	Sherwood Hydrologic Subarea
U-04.D0	Camarillo Hydrologic Subunit
U-04.D4	Arroyo Sequit Hydrologic Subarea
U-04.D5	Little Sycamore Canyon Hydrologic Subarea
U-04.D6	Deer Canyon Hydrologic Subarea
U-04.D7	Big Sycamore Canyon Hydrologic Subarea
U-04.D8	La Jolla Valley Hydrologic Subarea
U-05.00	Los Angeles-San Gabriel River Hydrologic Unit
U-05.B0	San Fernando Hydrologic Subunit
U-05.B1	San Fernando Hydrologic Subarea
V-00.00	San Joaquin Valley Hydrologic Unit









**LEGEND**

- Boundary of Investigational Area
- County Boundary
- - - National Forest Boundary
- ■ ■ Upper Santa Clara Valley Water Agency
- □ □ Antelope Valley-East Kern Water Agency

UNITS OF THE UNITED WATER CONSERVATION DISTRICT

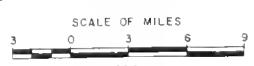
- SANTA CLARA RIVER VALLEY UNIT
- COLONIA UNIT
- DEL NORTE UNIT
- EAST OXNARD UNIT
- MUNO UNIT
- OCEAN VIEW UNIT
- OXNARD UNIT
- PLEASANT VALLEY UNIT
- U.S. NAVAL MISSILE CENTER UNIT

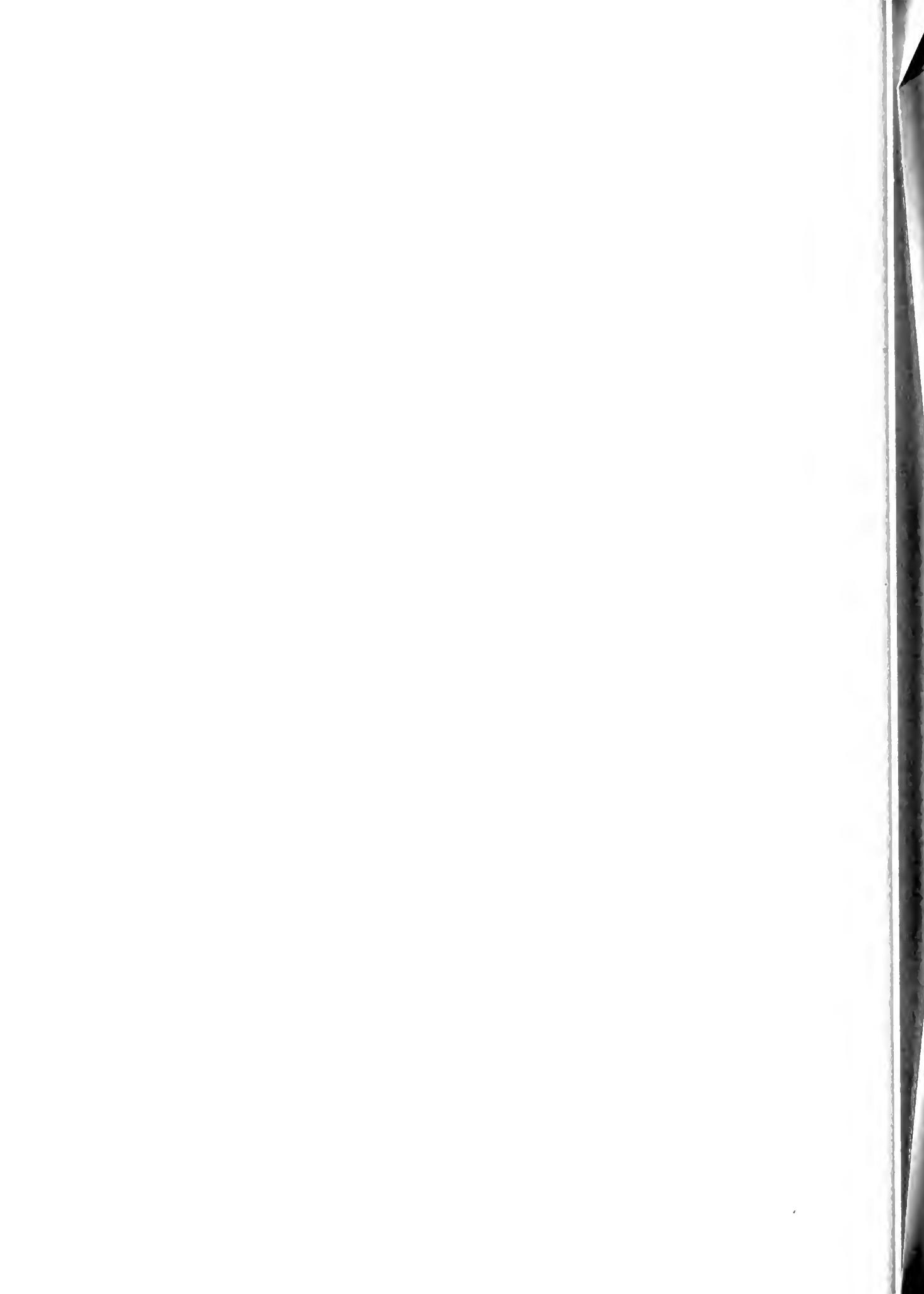
MUNICIPAL WATER DISTRICTS

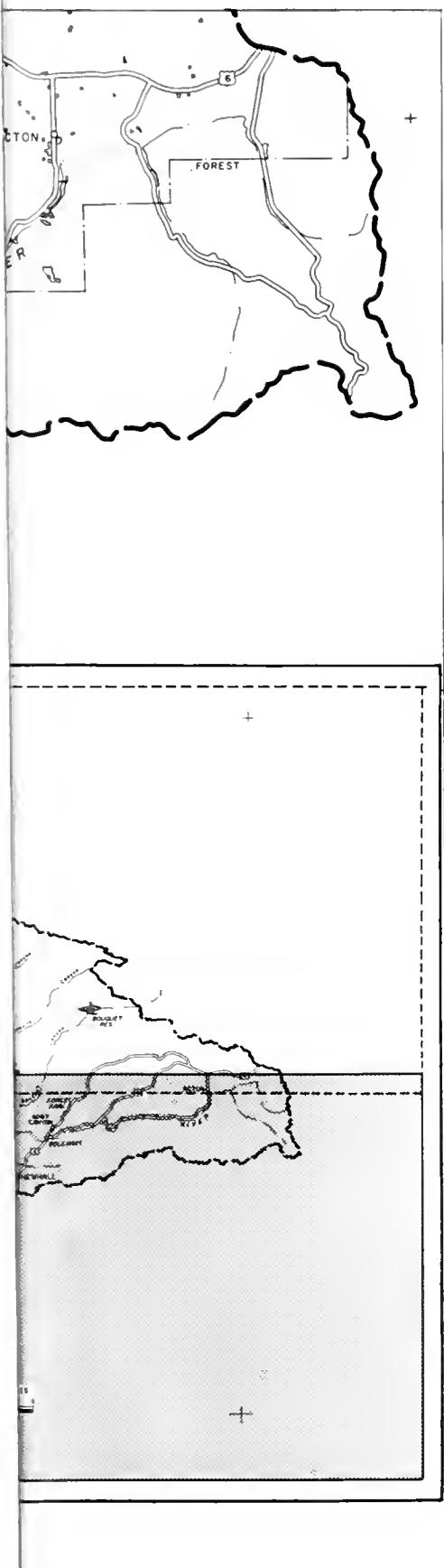
- CALLEGUAS
- VENTURA RIVER

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

VENTURA COUNTY AND UPPER SANTA CLARA RIVER
DRAINAGE AREA
LAND AND WATER USE SURVEY, 1961

MAJOR WATER AGENCIES





LEGEND

- Boundary of Investigational Area
- Boundary of Drainage Province
- Boundary of Hydrologic Unit
- Boundary of Hydrologic Subunit
- Boundary of National Forest
- [White box] Irrigated Agriculture
- [White box] Urban Residential
- [White box] Commercial
- [Light gray box] Industrial-Manufacturing and Processing
- [Light gray box] Industrial-Extractive, Storage, and Transportation
- [Hatched box] Military Reservation

U-04.B0 HYDROLOGIC UNIT AND SUBUNIT DESIGNATIONS

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

VENTURA COUNTY AND UPPER SANTA CLARA RIVER
DRAINAGE AREA
LAND AND WATER USE SURVEY, 1961

PRESENT LAND USE
1961

SCALE OF MILES
2 0 2 4 6
1964



DESIGNATIONS OF HYDROLOGIC UNITS AND SUBUNITS

PORTION OF CENTRAL COASTAL HYDROLOGIC PROVINCE

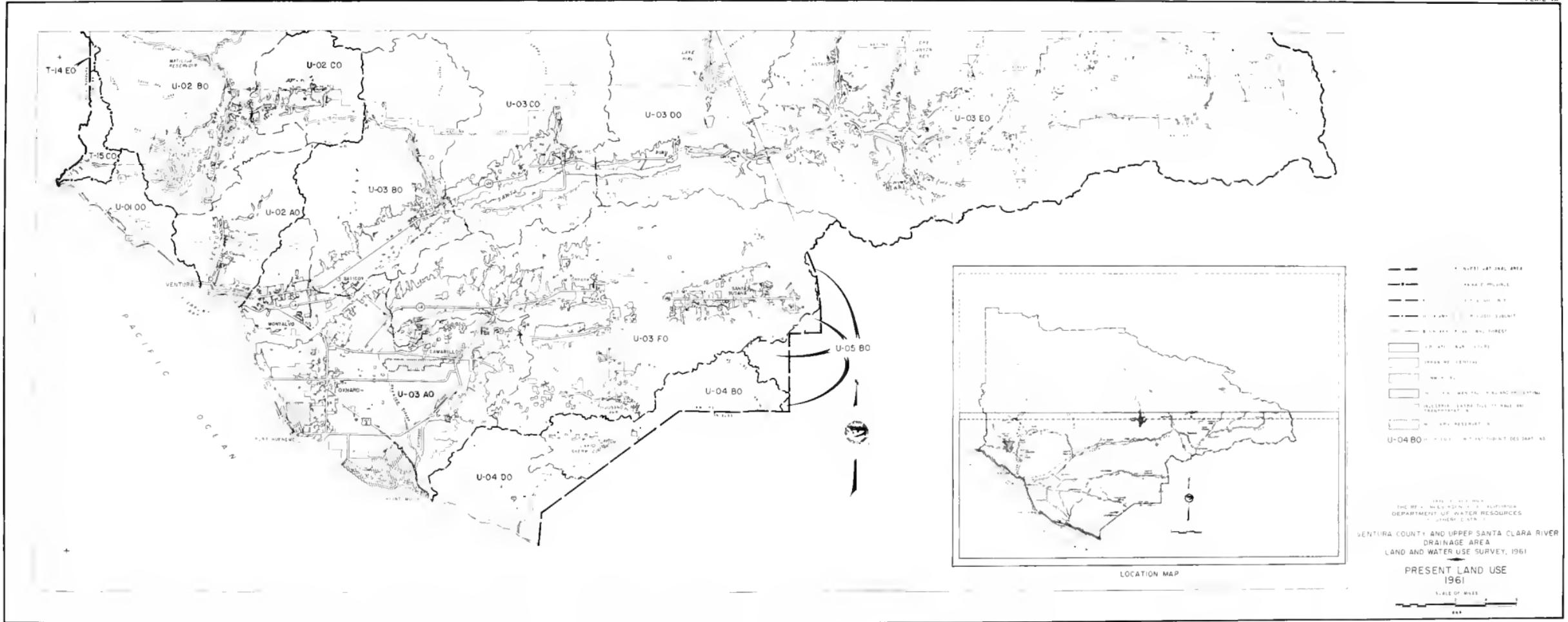
- | | |
|---------|------------------------------------|
| T-12.0F | Santa Maria-Cuyama Hydrologic Unit |
| T-12.0O | Cuyama Valley Hydrologic Subunit |
| T-14.00 | Santa Ynez Hydrologic Unit |
| T-14.80 | Headwater Hydrologic Subunit |
| T-15.00 | Santa Barbara Hydrologic Unit |
| T-15.0O | South Coast Hydrologic Subunit |

PORTION OF LOS ANGELES HYDROLOGIC PROVINCE

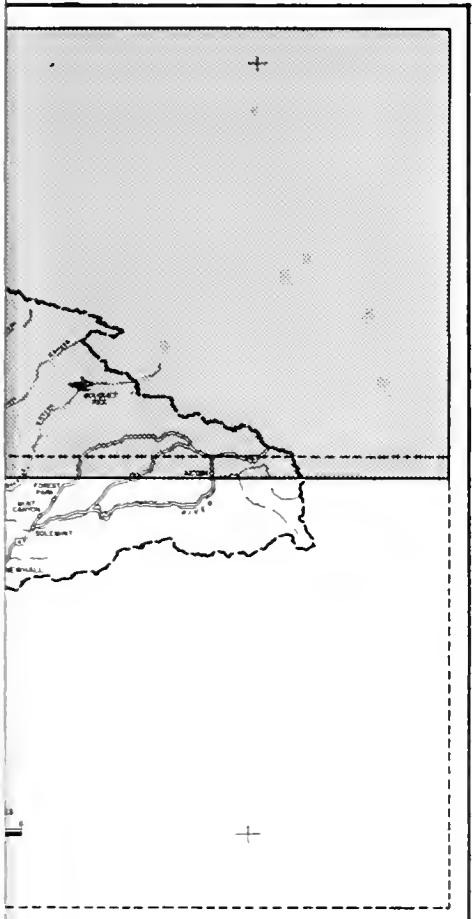
- | | |
|---------|---|
| U-01.00 | Rincon Creek Hydrologic Unit |
| U-02.00 | Ventura River Hydrologic Unit |
| U-02.A0 | Lower Ventura River Hydrologic Subunit |
| U-02.B0 | Upper Ventura River Hydrologic Subunit |
| U-02.C0 | Ojai Hydrologic Subunit |
| U-03.00 | Santa Clara-Callipus Hydrologic Unit |
| U-03.A0 | Oxnard Plain Hydrologic Subunit |
| U-03.B0 | Santa Paula Hydrologic Subunit |
| U-03.C0 | Sespe Hydrologic Subunit |
| U-03.D0 | Piru Hydrologic Subunit |
| U-03.E0 | Upper Santa Clara River Hydrologic Subunit |
| U-03.F0 | Callipus-Conejo Hydrologic Subunit |
| U-04.00 | Malibu Hydrologic Unit |
| U-04.B0 | Malibu Creek Hydrologic Subunit |
| U-04.D0 | Camarillo Hydrologic Subunit |
| U-05.00 | Los Angeles-San Gabriel River Hydrologic Unit |
| U-05.B0 | San Fernando Hydrologic Subunit |

PORTION OF SAN JOAQUIN VALLEY

- V-00.00 San Joaquin Valley Hydrologic Unit







LEGEND

- — — BOUNDARY OF INVESTIGATIONAL AREA
- • — BOUNDARY OF DRAINAGE PROVINCE
- — — BOUNDARY OF HYDROLOGIC UNIT
- * — BOUNDARY OF HYDROLOGIC SUBUNIT
- - — BOUNDARY OF NATIONAL FOREST
- [Light gray rectangle] IRRIGATED AGRICULTURE
- [White rectangle] URBAN RESIDENTIAL
- [White rectangle] COMMERCIAL
- [Light gray rectangle] INDUSTRIAL-MANUFACTURING AND PROCESSING
- [White rectangle] INDUSTRIAL-EXTRACTIVE, STORAGE, AND TRANSPORTATION
- [Hatched rectangle] MILITARY RESERVATION

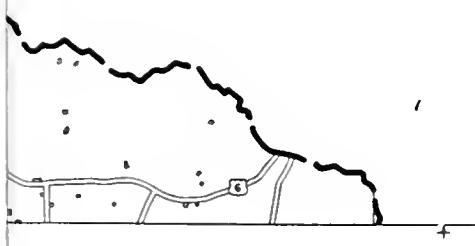
U-03.EO HYDROLOGIC UNIT AND SUBUNIT DESIGNATIONS

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

VENTURA COUNTY AND UPPER SANTA CLARA RIVER
DRAINAGE AREA
LAND AND WATER USE SURVEY, 1961

**PRESENT LAND USE
1961**

SCALE OF MILES
2 0 2 4 6
1964





DESIGNATIONS OF HYDROLOGIC UNITS AND SUBUNITS

PORTION OF CENTRAL COASTAL HYDROLOGIC PROVINCE

T-12.00
T-12.00
Santa Maria-Cuyama Hydrologic Unit
Cuyama Valley Hydrologic Subunit

T-14.00
T-14.00
Santa Ynez Hydrologic Unit
Headwater Hydrologic Subunit

T-15.00
T-15.00
Santa Barbara Hydrologic Unit
South Coast Hydrologic Subunit

PORTION OF LOS ANGELES HYDROLOGIC PROVINCE

J-01.00
Rincon Creek Hydrologic Unit

U-02.00
U-02.00
Lower Ventura River Hydrologic Subunit

U-02.00
Upper Ventura River Hydrologic Subunit

Ojai Hydrologic Subunit

I-03.00
I-03.00
Santa Clara-Calleguas Hydrologic Unit

Oxnard Plain Hydrologic Subunit

J-03.00
Santa Paula Hydrologic Subunit

J-03.00
Sequoia Hydrologic Subunit

J-03.00
Piru Hydrologic Subunit

U-03.00
Upper Santa Clara River Hydrologic Subunit

U-03.00
Calleguas-Conejo Hydrologic Subunit

U-04.00
U-04.00
Malibu Hydrologic Unit

U-04.00
Malibu Creek Hydrologic Subunit

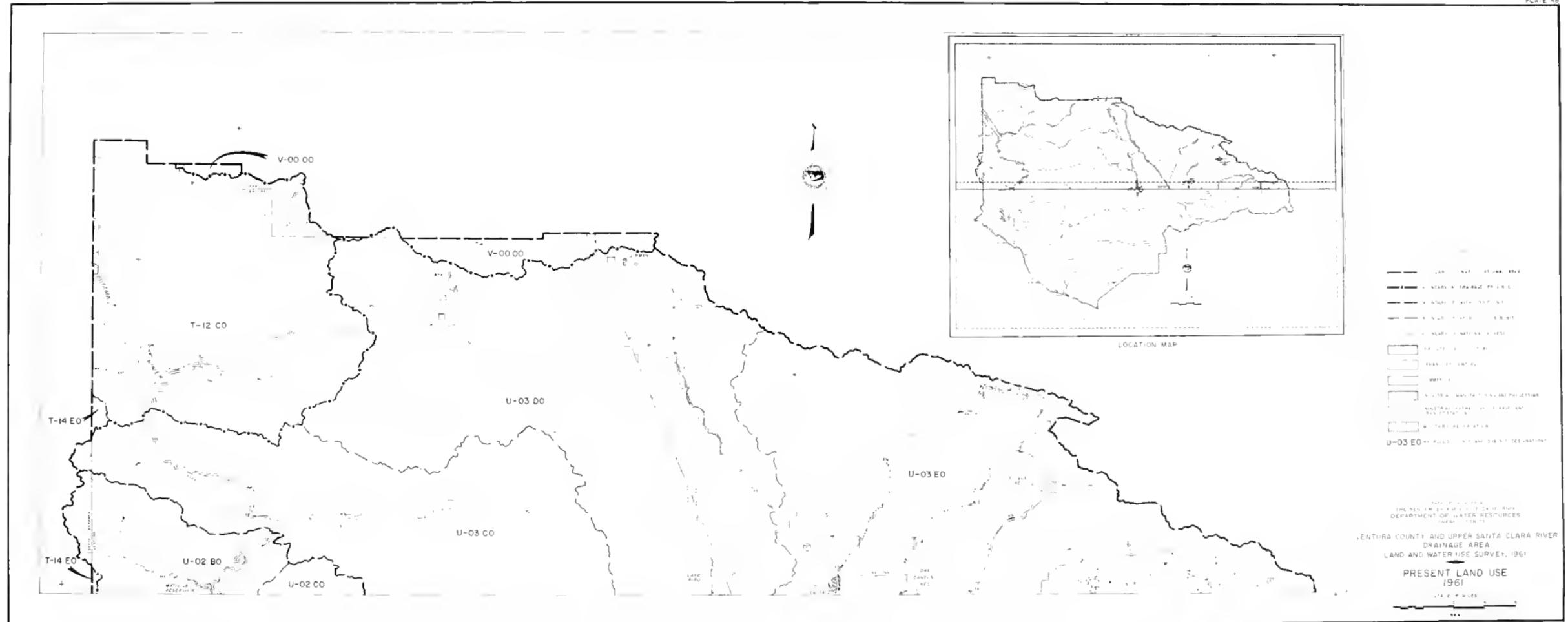
U-04.00
Camarillo Hydrologic Subunit

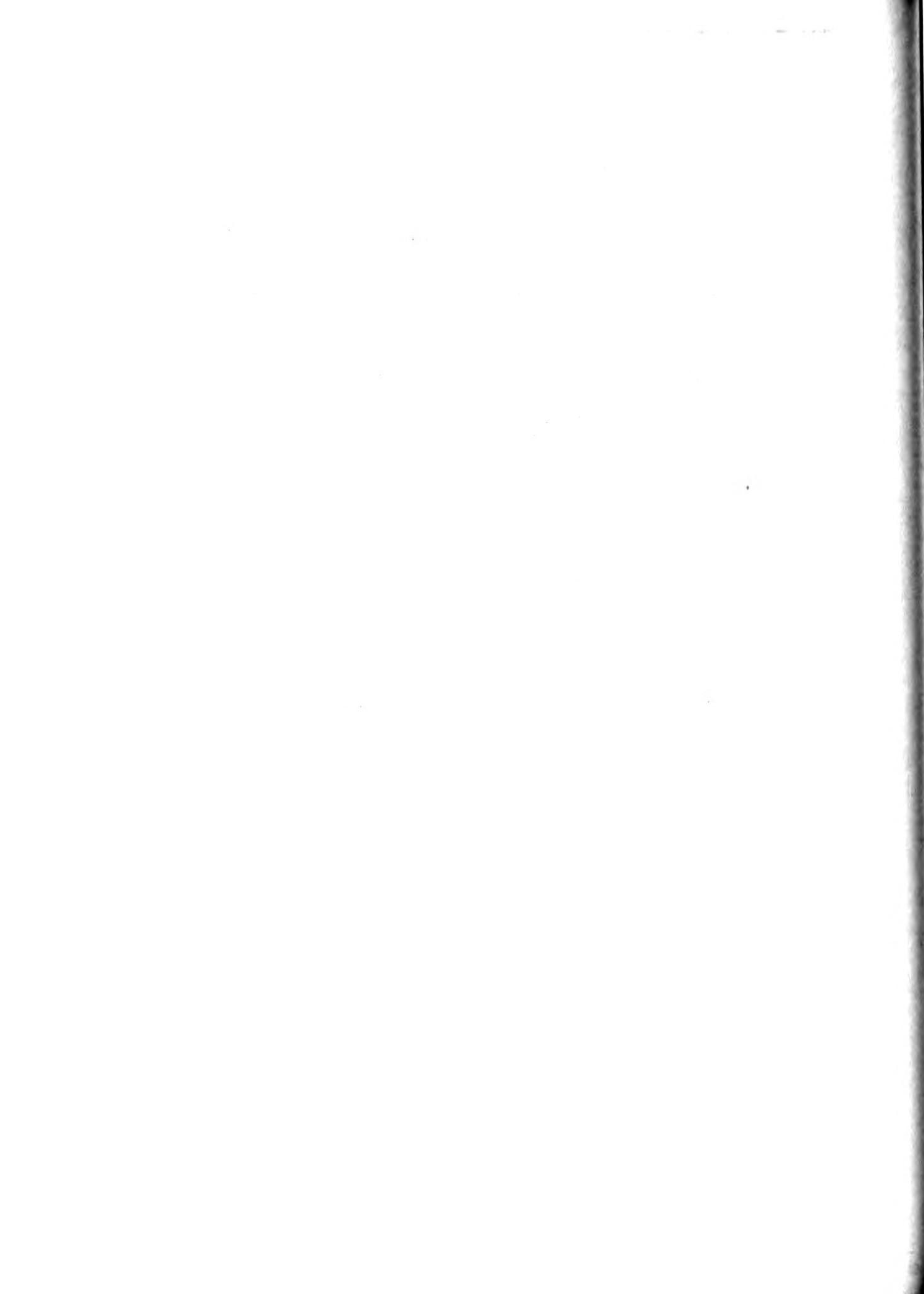
U-05.00
U-05.00
Los Angeles-San Gabriel River Hydrologic Unit

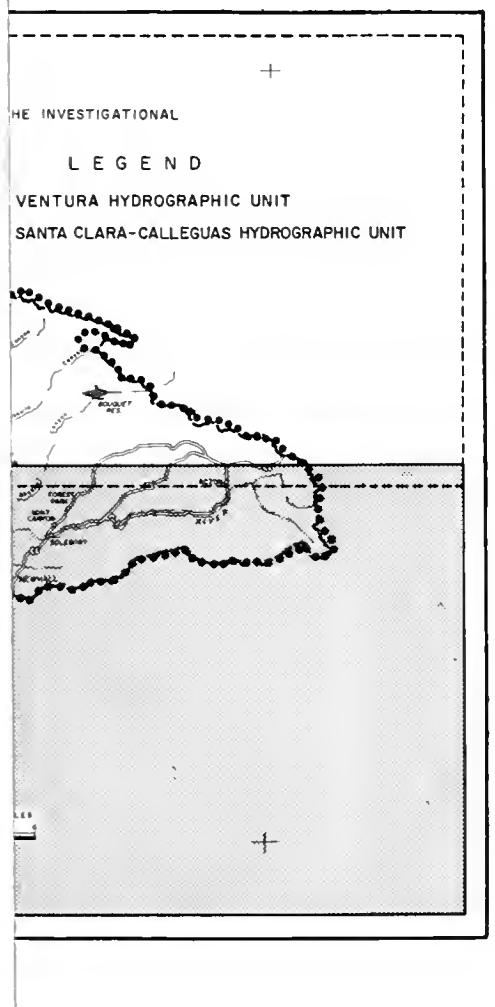
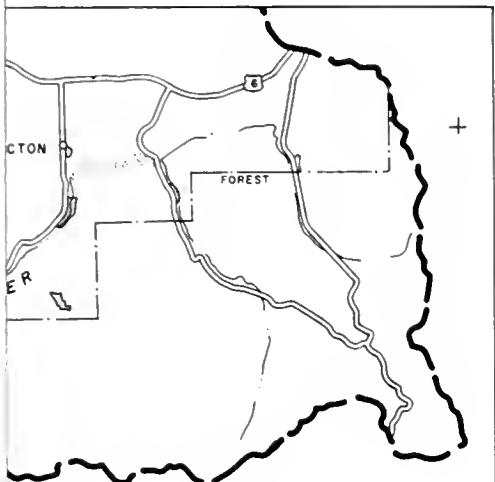
U-05.00
San Fernando Hydrologic Subunit

PORTION OF SAN JOAQUIN VALLEY

V-00.00
San Joaquin Valley Hydrologic Unit







LEGEND

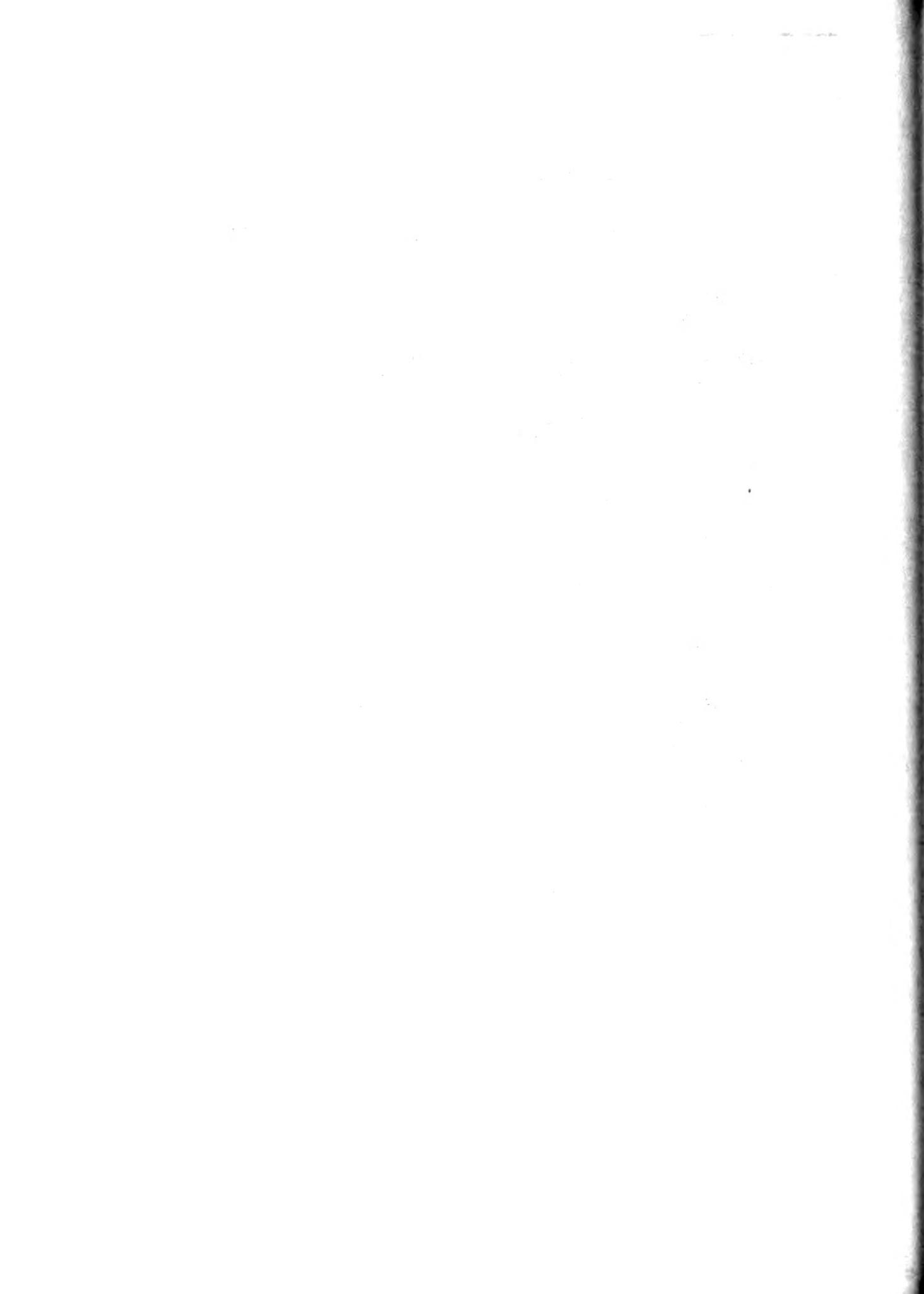
- — — BOUNDARY OF INVESTIGATIONAL AREA
- ● — BOUNDARY OF DRAINAGE PROVINCE
- — — BOUNDARY OF HYDROLOGIC UNIT
- U-05.B0** HYDROLOGIC UNIT AND SUBUNIT DESIGNATIONS
- [Solid light gray box] IRRIGATED AGRICULTURAL EXPANSION
- [White box] URBAN AND SUBURBAN AREAS EXPANSION
- [Hatched box] MILITARY RESERVATION

STATE OF CALIFORNIA
THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
SOUTHERN DISTRICT

VENTURA COUNTY AND UPPER SANTA CLARA RIVER
DRAINAGE AREA
LAND AND WATER USE SURVEY, 1961

MAJOR CHANGE IN LAND USE
1950 TO 1961

SCALE OF MILES
2 0 2 4 6
1964



DESIGNATIONS OF HYDROLOGIC UNITS AND SUBUNITS

PORTION OF CENTRAL COASTAL HYDROLOGIC PROVINCE

- I-12.00
I-12.00
Santa Maria-Cuyama Hydrologic Unit
Cuyama Valley Hydrologic Subunit
- I-14.00
I-14.00
Santa Ynez Hydrologic Unit
Headwater Hydrologic Subunit
- I-15.00
I-15.00
Santa Barbara Hydrologic Unit
South Coast Hydrologic Subunit

PORTION OF LOS ANGELES HYDROLOGIC PROVINCE

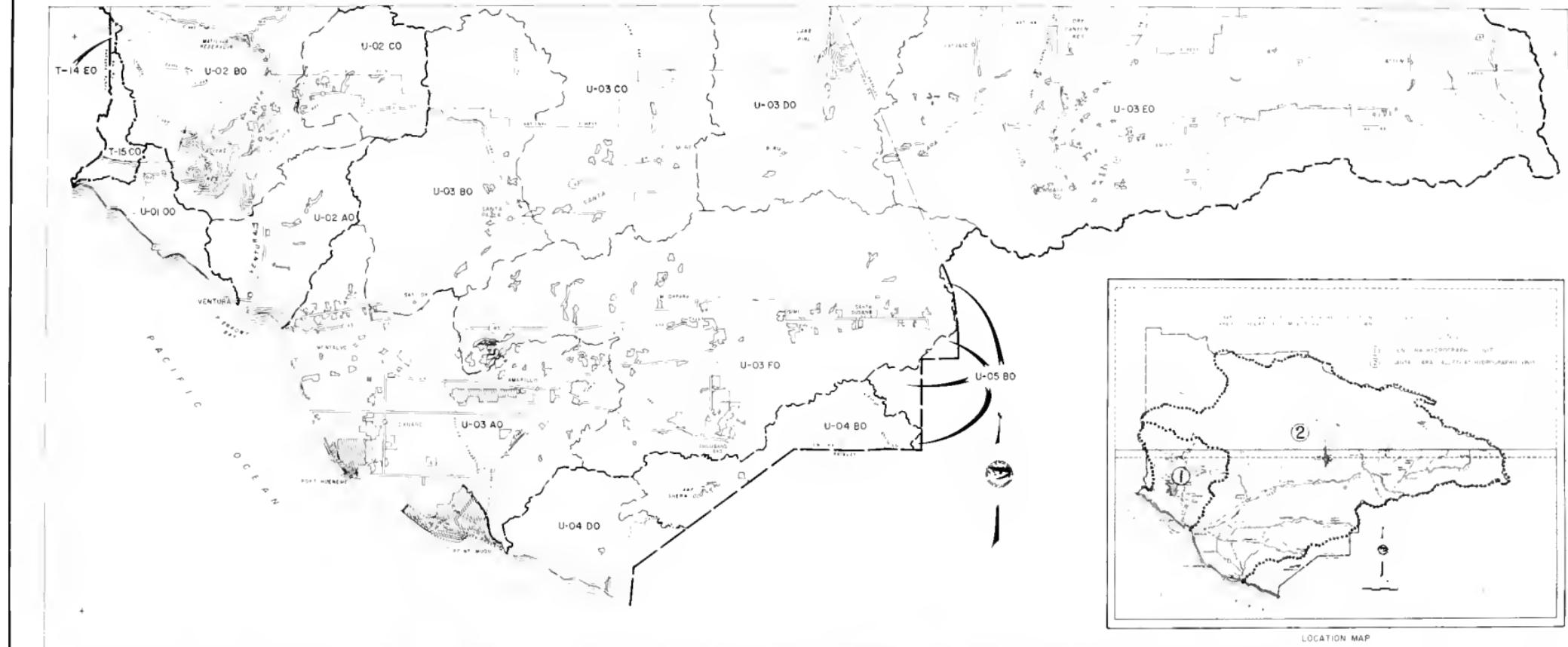
- J-1.00
Birch Run Creek Hydrologic Unit
- U-02.00
U-02.00
Ventura River Hydrologic Unit
Lower Ventura River Hydrologic Subunit
- U-02.00
U-02.00
Upper Ventura River Hydrologic Subunit
- U-02.00
U-02.00
Ojai Hydrologic Subunit
- J-1.00
U-03.00
U-03.00
Santa Clara-Caliaguas Hydrologic Unit
Oxnard Plain Hydrologic Subunit
- J-1.00
U-03.00
Santa Paula Hydrologic Subunit
- J-1.00
U-03.00
Sequoia Hydrologic Subunit
- J-03.00
U-03.00
Piru Hydrologic Subunit
- J-03.00
U-03.00
Upper Santa Clara River Hydrologic Subunit
- J-03.00
U-03.00
Caliaguas-Conejo Hydrologic Subunit

- U-04.00
U-04.00
U-04.00
Malibu Hydrologic Unit
Malibu Creek Hydrologic Subunit
- Camarillo Hydrologic Subunit

- U-05.00
U-05.00
Los Angeles-San Gabriel River Hydrologic Unit
San Fernando Hydrologic Subunit

PORTION OF SAN JOAQUIN VALLEY

- V-00.00
San Joaquin Valley Hydrologic Unit



LEGEND

- BOUNDARY OF STATE, CALIFORNIA
- BOUNDARY OF DRAINAGE PROVINCE
- BOUNDARY OF HYDROLOGIC UNIT
- U-05 BO HYDROLOGIC UNIT AND SUBUNIT DESIGNATION
- RELATED AGRICULTURAL EXPANSION
- URBAN AND SUBURBAN AREA EXPANSION
- MILITARY RESERVE LAND

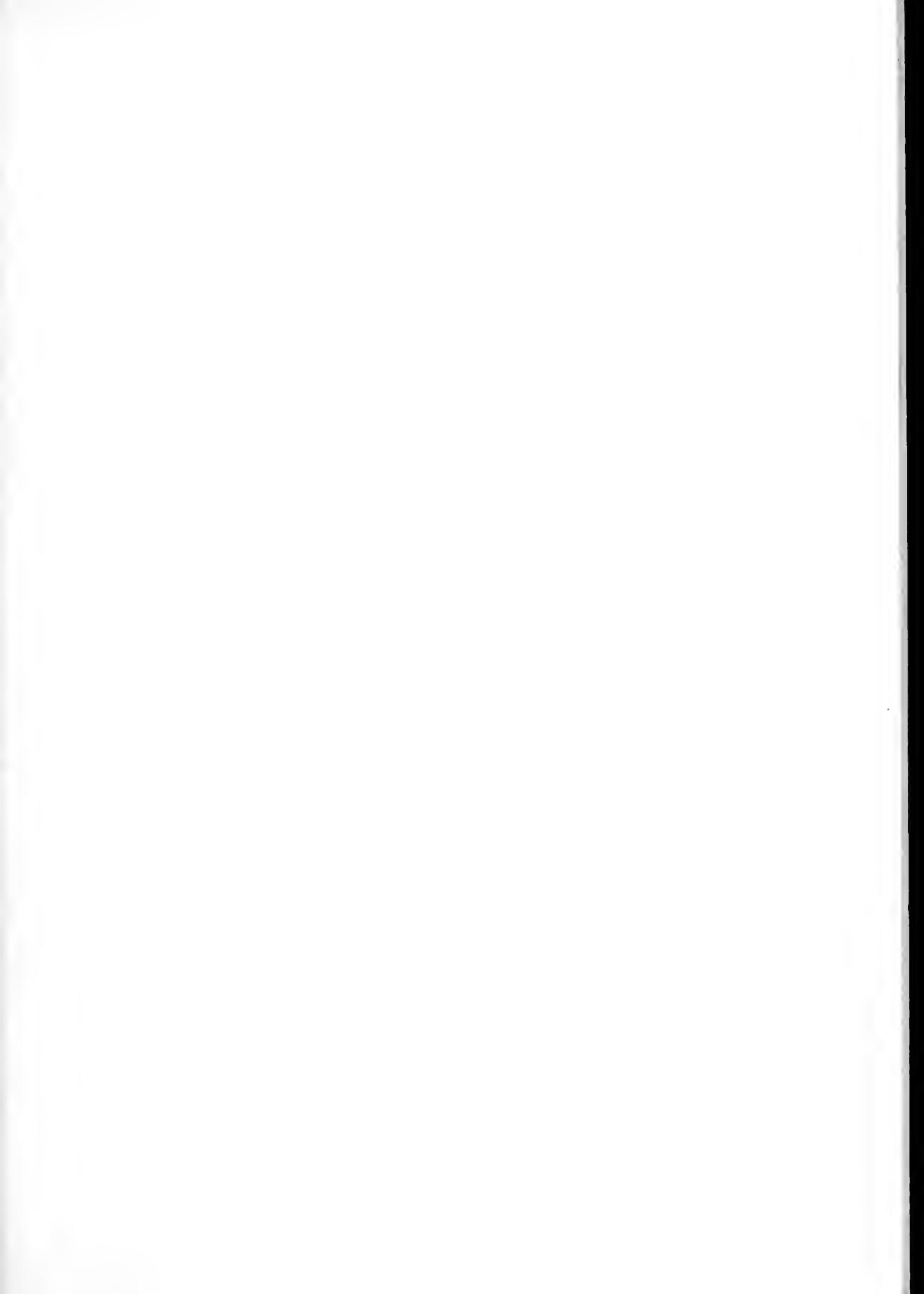
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THE RED PLAN FOR CALIFORNIA
DEPARTMENT OF WATER RESOURCES
NORTHERN DISTRICT

VENTURA COUNTY AND UPPER SANTA CLARA RIVER
DRAINAGE AREA
LAND AND WATER USE SURVEY, 1961

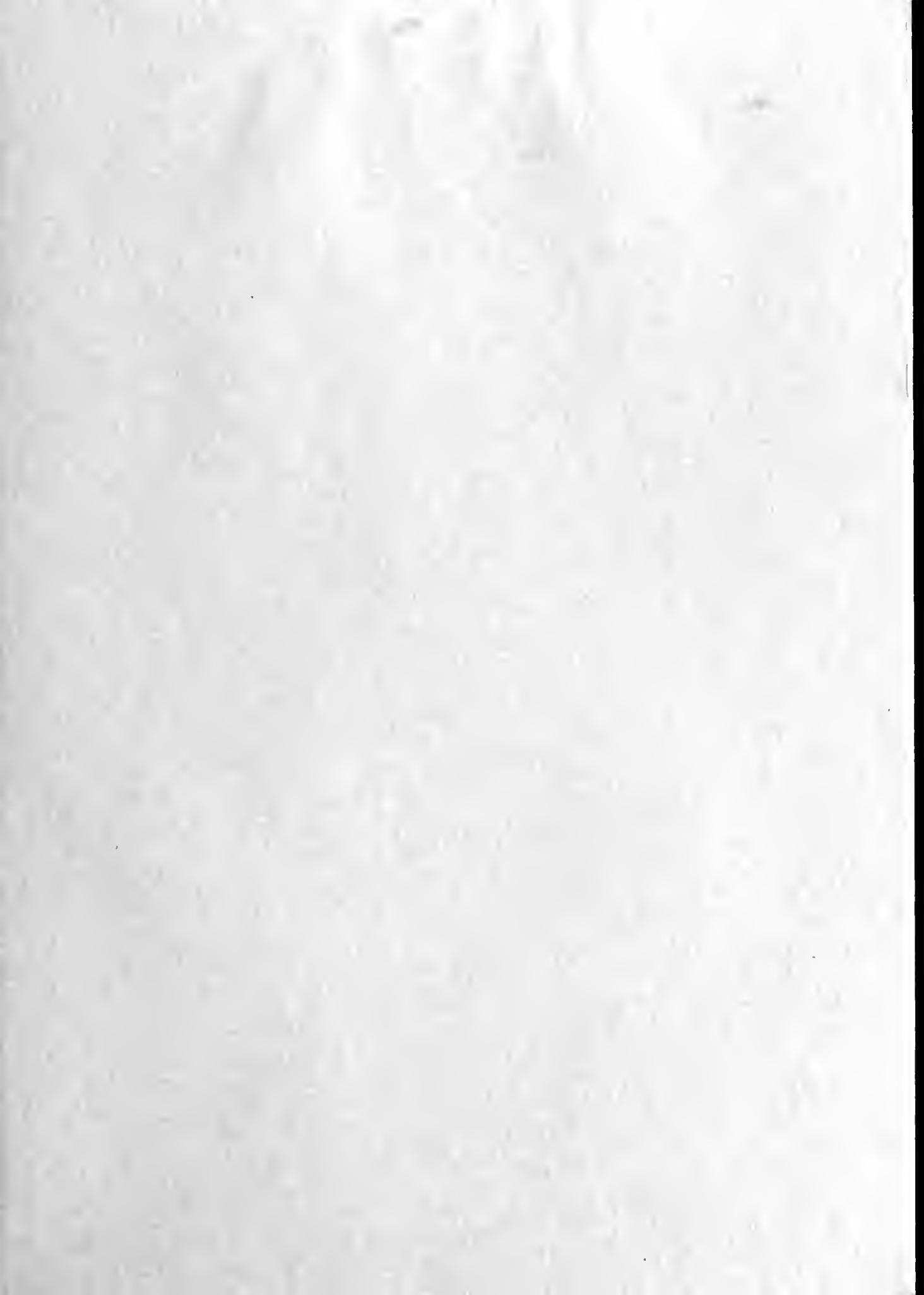
MAJOR CHANGE IN LAND USE
1950 TO 1961

SCALE OF MAP
1 mile
1 km
1000 m





for



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